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Operative System for Strategic Sustainable Development—Coordinating Analysis, Planning, Action, and Use of Supports Such as the Sustainable Development Goals, Planetary Boundaries, Circular Economy, and Science-Based Targets

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ABSTRACT

The number of sustainability supports keeps growing. However, they are typically not capable of bridging planetary-to-organizational scales and therefore in themselves provide limited guidance for how organizations can contribute strategically to global sustainability. This is severe since the power of change that organizations represent is essential for humanity to succeed with the transition to sustainability. Furthermore, a specific sustainability support typically lacks a clear description of what gap it is designed to fill. This may add confusion to an already complex area and can result in organizations selecting supports that are not the most appropriate for the organization's purpose and transition plan. The aim of this study was therefore to prototype an approach for SWOT analyses of sustainability supports and for guiding effective and coordinated use of them. We tested the approach for some examples of supports that are currently receiving much attention: the sustainable development goals, planetary boundaries, circular economy, and science-based targets. We argue that the tested approach can be generalized and makes it possible to clarify limitations and value of any support from a systemic, systematic, and strategic sustainability perspective and, therefore, also to clarify how the supports relate to each other and can be selected and used in an effective and coordinated way. This is similar to how an operative system of, say, a smartphone, facilitates an effective and coordinated use of apps. We argue that the presented approach addresses one of the most dangerously, still most commonly, missed pieces in public and private discourses on sustainability.

1 | Introduction

Transitioning to sustainability is urgent as we are rapidly approaching likely tipping points beyond which the ongoing degradation of the foundation for civilization risks becoming self-reinforcing and unstoppable (Steffen et al. 2015, 2018; Armstrong McKay et al. 2022). A successively deepening awareness of this has resulted in extensive sustainability research and from that we have gained increasing knowledge regarding impacts, trajectories of impacts and potential impacts, as well as many proposals for technical, political, and other types of specific solutions. We have also gained an increasing number of

tools, methods, concepts, frameworks, and other forms of specific supports for various aspects of sustainable development.

1.1 | Need for Structured and Cohesive Uses of Sustainability Knowledge, Tools, and Other Supports

The research and outcome described above have great value. However, since the challenges are interrelated, it will not suffice for solving the collective, fundamental sustainability challenge, and not even for solving singular challenges such as climate change. We need systemic, systematic, and strategic approaches capable of bridging disciplines, sectors, and planetary-to-organizational scales to guide leadership, governance, innovation, and problem-solving (e.g., Whiteman, Walker, and Perego 2013; Bai et al. 2016; Dyllick and Muff 2016; Broman et al. 2017; Ranängen et al. 2018; Valencia et al. 2019; Ordonez-Ponce, Clarke, and MacDonald 2021).

Without considering the full scope of sustainability, there is a significant risk of suboptimized or counterproductive attempts for solutions, which risk creating new problems. To succeed with a rapid shift to sustainability, we also need means to inspire proactivity, for example, means to increase the understanding among organizations of the self-benefit of competent proactivity (e.g., McNall, Hershauer, and Basile 2011; Willard 2012; Robèrt and Broman 2017). Taking the lead and strategically developing the solutions that will be increasingly in demand in the face of sustainability-related challenges to civilization is a major opportunity for improved competitiveness of companies. Governments developing coordinated legislation and other policy measures from such an understanding is a major opportunity for national and regional success (e.g., Robèrt and Broman 2017; Wilts and O'Brien 2019).

The need for systemic, systematic, and strategic leadership and innovation for sustainability has called for the evolution of a special branch of sustainability science. Parts of this were collected in a thematic volume of the *Journal of Cleaner Production* (Broman et al. 2017). This science is different from detailed studies of specific aspects of sustainable development such as climate change or policymaking, it is different from attempts to derive specific solutions and organizational strategies directly from knowledge of negative impacts at the planetary level, and it is different from developing more and more specific sustainability supports. To succeed with sustainable development, we need to make better use of all of this from a systems perspective and a well-thought-through metaphase between the planetary and organizational scales.

1.2 | Some Well-Known Sustainability Supports and Their Characteristics

Some of the existing supports are of macrolevel type, that is, they reside on planetary level or regional level. Some examples are the United Nation (UN)'s Agenda 2030 and its sustainable development goals (SDGs, e.g., UN 2015) and the planetary boundaries (e.g., Richardson et al. 2023). Creating the ability to make sense of and strategically use such supports at the level of individual organizations is important as proactivity among companies, municipalities, and other organizations is essential for society's transition to sustainability as well as for the success of the organization. International agreements, national legislation, and other policy measures are valuable to push for change but will not be sufficient for the needed urgent shift to sustainability without organizations realizing and acting on their self-benefit of being proactive (Robèrt and Broman 2017). The organizational level, in the private as well as public sectors, is key if we are to achieve a rapid shift. However, it is challenging to make direct effective use of macrolevel supports like the above in organizations (e.g., Ranängen et al. 2018). These supports have not been designed for organizations. The goals, boundaries, and targets are not set at the organizational level and no concrete procedural support is included for how to systematically and strategically relate organizational goals, action plans, and indicators to these macrolevel supports. A related problem is that these supports do not include a science-based, fixpoint-type definition of full sustainability that is concrete enough to guide innovation, governance, and sustainability transitions. A lack of such a fixpoint risks resulting in organizations deviating apart along myriad uncoordinated efforts, hampering effective cooperation across value-chains and wider stakeholders, sectors, and multilateral institutions (e.g., Broman et al. 2017; Bratt, Sroufe, and Broman 2021; Missimer and Mesquita 2022).

Some of the existing supports are of microlevel type, that is, they are designed for use at the organizational level. Some examples are circular economy (e.g., Kirchherr, Reike, and Hekkert 2017), life cycle assessment (e.g., ISO 2006), and many other supports for product-developing companies. Just in the context of product development, hundreds of tools and methods have been proposed, and still, they have been considered insufficient for effective integration of sustainability aspects in relevant company processes (Brones and Monteiro De Carvalho 2015; Faludi et al. 2020). A problem with many of these supports is a lack of a clear connection to the macro level, and in most cases, there is also here a lack of a science-based, fixpoint-type definition of full sustainability valid at any scale (e.g., Watz and Hallstedt 2018). Benchmarks are often made in relation to previous performance or what other organizations do, using some selected indicators not derived from a fixpoint-type definition of full sustainability (e.g., Abdela, Roquet, and Zeaiter 2016). This resembles "navigating by watching other ships not knowing where to go."

For the reasons above, there is clearly a need to link the planetary and organizational levels to achieve a cohesive and effective use of various sustainability supports in organizations. A recent attempt to translate planetary goals to organizational goals is called science-based targets (SBT 2020). This attempt has merits but is also insufficient and risks leading to suboptimized actions, as it is focused on one problem area (climate) rather than the full scope of sustainability. Climate-focused efforts could then cause severe problems in other problem areas. It partly also misses the strategic perspective, that is, it does not clarify the economic dynamics of the sustainability challenge and related opportunities at different scales, and thus not the possible self-benefit of innovative proactivity beyond "fair shares" of costs.

As indicated above, the many existing sustainability supports have many merits. They are fit for what they are designed to do.

However, to not clarify how the supports relate to the full scope of sustainability, and through that being able to clarify how they relate to each other and can be linked over planetary and organizational levels, is a lost opportunity when it comes to making the best use of each support and for finding out how to best combine different supports for systemic, systematic and strategic sustainability work in organizations. The aim of this study is therefore to prototype an approach for SWOT analyses of sustainability supports *and* for effective and coordinated use of them in planning, execution, and monitoring of organizational transitions, taking the above insights into account. We test the approach for some examples of sustainability supports that are currently receiving much attention: the SDGs (macrolevel support), planetary boundaries (macrolevel support), circular economy (microlevel support), and SBTs (translation of global climate goals to organizational goals).

2 | Methods

SWOT analysis is a well-known method for identifying and clarifying strengths, weaknesses, opportunities, and threats regarding, for example, an organization's capabilities and strategies (e.g., Madsen 2016). Based on the problems, insights, and aim described in the introduction, we prototype an approach that combines the standard SWOT analysis with specific features extracted from the Framework for Strategic Sustainable Development (FSSD) to match the needs of this study. The extracted and combined features are (based on Broman and Robèrt 2017):

i. **A funnel metaphor** facilitating a systemic view of civilization's sustainability challenge and how this will, inevitably, influence all organizations and their practices, thus making global sustainability relevant to leaders and their organizations. The in-leaning wall of the funnel represents the dynamics of unsustainability, a systematic decline of assimilation capacity and purity, climate regulation capacity, biodiversity, etcetera, in forests, croplands, seas, and other parts of nature, as well as trust between people and institutions, social diversity, etcetera, in social systems. These capacities of ecological and social systems, needed to sustain civilization as we know it, are declining systematically because of society's current violations of basic principles for sustainability (see [ii]). The funnel metaphor enables understanding of subsequent, inevitable changes of markets and political demands, which creates a "self-beneficial drive" to improve on *risk management* and to prepare in time for *innovative value offers* that will support society's transition to sustainability (the opening of the funnel). As such, it aids deeper understanding of the individual organization's self-benefit of being competently proactive in the face of the dynamics of rapidly changing conditions in society and on markets due to the current unsustainable basic design and operation of society.

ii. **A principled definition of sustainability** that spans the opening of the funnel. The principles have been elaborated to be useful as boundary conditions for backcasting planning and redesign toward sustainability. The aim has been to find the precise boundary inside of which any vision (including goals) is sustainable, outside of which no vision is sustainable, and for the principles to not only be theoretically robust but also hands-on applicable in practice. They have therefore been elaborated with the following criteria in mind. The sustainability principles (SPs) should be: (i) *necessary* for sustainability, but not more to avoid imposing unnecessary restrictions and to avoid confusion over elements that may be disputable; (ii) *sufficient*, to avoid gaps in the thinking, that is, to allow elaboration into second and higher orders of principles from a complete and reliable base; (iii) *general*, to be applicable on any arena, at any scale, by any member in a team and all stakeholders, regardless of fields of expertise, to allow for cross-disciplinary and cross-sector collaboration; (iv) *concrete*, to actually guide hands-on problem-solving and innovation, that is, redesign through step-by-step approaches in real life; and (v) *nonoverlapping*, to enable comprehension and facilitate the development of indicators for monitoring of progress. The SPs are expressed as negations of basic mechanisms (root causes) of the destruction of ecological and social systems and constitute a fixpoint-type definition of full sustainability designed to be unifying and operationally applicable at all scales. The current phrasing is given in Appendix A.

iii. **An operational procedure (ABCD)** for navigating any project, organization, or region strategically within the funnel. The ABCD procedure is designed to support creative multistakeholder co-creation of strategic transitions toward visions framed by the above definition of sustainability. The steps are (A) elaborating/modeling visions/goals within the frame of the mentioned SPs; (B) backcasting and identifying current challenges and assets in context of the visions/goals; (C) identifying possible measures to bridge the gap to the vision in light of the identified challenges and assets; and (D) prioritizing among the possible measures into a stepwise transition plan where each measure is evaluated in terms of its capacity (e.g., in technical and economic terms) to serve as a viable and flexible platform for forthcoming steps. The aim of the prioritization is to place the organization at the cutting edge, that is, not being too late with investing in and developing new practices and offerings for the increasingly sustainability-driven market and society and not being too far ahead risking insufficient returns on investments. The ABCD procedure thus constitutes procedural support for self-beneficial systemic, systematic, and strategic sustainability work in organizations.

These features are schematically illustrated in context of each other in Figure 1. Doing "ABCD in the funnel," where the SPs span the opening of the funnel (define sustainability), is the essence of strategic sustainable development (SSD).

The SSD approach implies that for an individual actor, the aim should be to stepwise redesign all aspects of its operations to eventually *not contribute* in any way to unsustainability at any scale, that is, to not *contribute* to society's violation of the SPs. This also offers an improved opportunity to better understand and utilize the self-benefit of this, as well as the self-benefit of developing and offering value offers to help other actors on

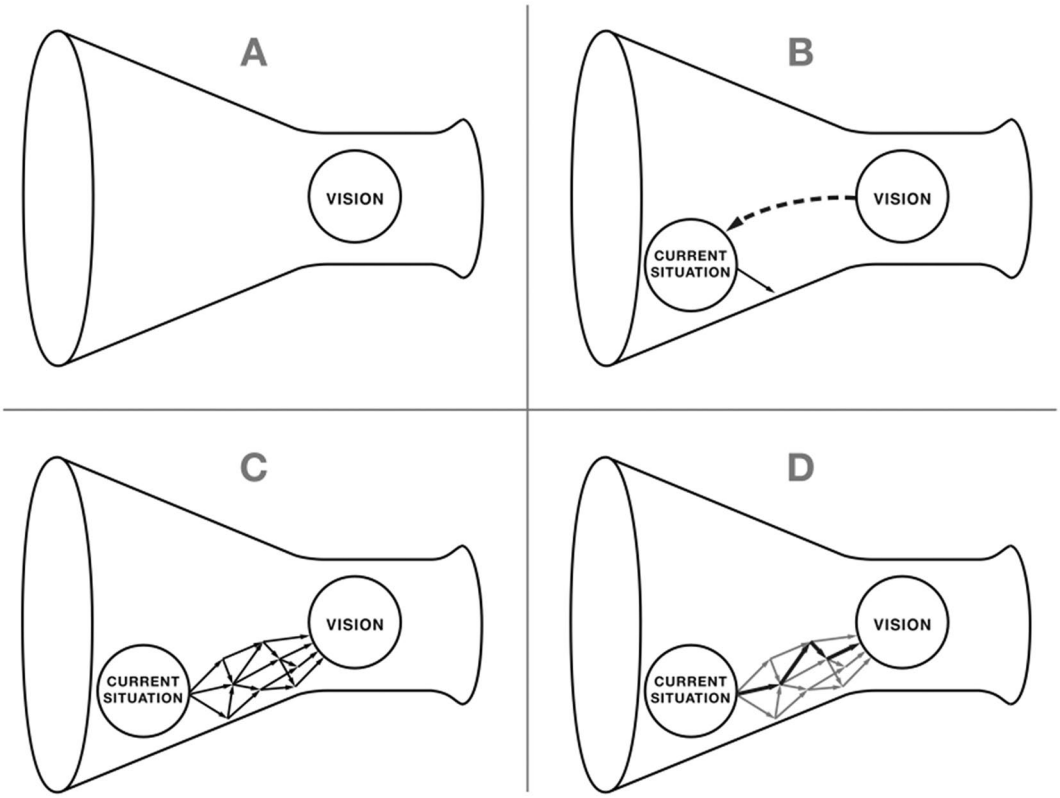

FIGURE 1 | Essence of an SSD approach. The funnel metaphor clarifies the systemic and systematic character of the sustainability challenge as well as the self-benefit of working strategically toward a sustainable vision. The cylindrical part (opening) of the funnel is spanned by the SPs, which frame any sustainable scenario/vision. The ABCD procedure implies that a sustainable vision is captured in (A), current challenges and assets in relation to the vision are captured in (B), possible steps toward the vision are captured in (C), and these are prioritized into a strategic plan in (D). *Reproduced from* (Broman and Robèrt 2017).

markets prepare for timely changes in their transitions. This phrasing in relation to the SPs, along with the funnel metaphor, provides a combined means for linking the planetary and organizational levels in support of concrete redesign. As the SPs are negations of destruction mechanisms at the root of cause-effect chains, the sum of all contributions to society's violations of the SPs causally explains the full panorama of sustainability-related problems across all scales (e.g., increasing climate change, increasing pollution, shrinking biodiversity, decreasing trust, and increasing social unrest in many parts of the world). In other words, stepwise eliminating one's *contribution* to society's violation of the SPs is *the* core organizational design strategy to support global sustainability as well as the organization's own successful innovation of value offers, risk management, and handling of trade-offs in view of the funnel dynamics.

See Broman and Robèrt (2017) for a more comprehensive discussion of the benefits of boundary conditions in the form of basic principles. Here is just a brief analogy with cancer treatment (another complex task in a complex system). When the monoclonal genesis of this disease—upstream in cause-effect chains that explain myriad symptoms downstream—became known, it became possible to derive basic, universal principles for cure. Because these are now known, that is, to (i) kill the last cancer stem cell but without (ii) killing the patient, professionals from many different fields can collaborate effectively in a backcasting mode toward that common, basic understanding of success. These basic principles have guided the search for specific knowledge and development of specific equipment, methods, and other types of support. A common understanding of this principled goal has also allowed for a coordinated use of the specific knowledge and the specific supports in practice. Before these principles were known, the causality of the myriad impacts downstream were not understood—anemia, fatigue, weight loss, dysfunctional organs, pains, etcetera. Medical professionals were chasing symptoms and most patients with disseminated disease did not survive for very long. Today, more than half of the patients are cured. We need to design root causes of problems out of the system this way also in the sustainability realm, where the societal discourse is often based on a poor understanding of how the symptoms are interconnected and rooted upstream in cause-effect chains.

In summary, we believe that the indicated special qualities of the above features (funnel metaphor, SPs, ABCD procedure) make the combination of them useful as a core of a lens for SWOT analyses of sustainability supports.

More explicitly, when assessing *strengths* versus *weaknesses* we are, for example, considering whether or not, or to what degree, the analyzed support:

- Aids a *systemic* approach, that is, provides a science-based and operationally applicable definition of full socioecological sustainability clarifying root causes of unsustainability;

clarifies the dynamics and urgency of addressing these root causes; guides upstream problem-solving, redesign, and innovation as well as prevention of new and unknown problems; and promotes a systems perspective to encompass and bridge multiple disciplines, sectors, stakeholders, and planetary-to-organizational scales; all of this for the actor to be able to contribute to systemic change and not only isolated and fractional change (which may be suboptimal both for society and the specific actor).

- Aids a *systematic* approach, that is, provides, or aids the actor to apply, well-defined, structured and consistent work procedures and leadership and innovation methods; and promotes and guides effective and coordinated use of other supports; all of this for the actor to be able to be focused and not distracted by temporary "sustainability hypes" and ad-hoc methods.
- Aids a *strategic* approach, that is, aids the actor to create and implement economically viable, self-beneficial stepwise change paths to sustainable visions, including handling trade-offs strategically and revising these paths iteratively as the contextual conditions change in ways not possible to predict in detail; all of this for the actor to be able to balance its proactivity for both short-term and long-term success and by doing so mitigate paralysis from a perception of overwhelming challenges and instead promote hope and enthusiasm for a realistic stepwise transition.
- Is backed up by credible organizations and has been communicated and is known, as these are also factors of importance for the credibility and enthusiasm around the support and thus for its potential utility and impact.

These aspects are considered individually and taken together.

Then, it is assessed whether or not, or to what degree, there are *opportunities* for the analyzed support to function well together with a guiding systemic, systematic, and strategic sustainability approach as described above and together with other supports. Finally, it is assessed whether or not, or to what degree, there are potential *threats* to effective and coordinated sustainability work in organizations due to certain characteristics of the analyzed support.

This SWOT application also constitutes a new, additional way of testing the indicated special qualities of the SSD approach. If this SSD-informed lens works well to clearly display the analyzed supports in the SWOT format, including to guide an effective and coordinated use of the supports for systemic, systematic, and strategic sustainability work in organizations, it becomes added evidence for these qualities of the SSD approach.

3 | Results

3.1 | Analysis Results

Using of the above-presented SSD approach as a core of a lens, we here perform SWOT analyses of some specific sustainability supports that currently receive much attention; the UN's SDGs, planetary boundaries, circular economy, and SBTs. For each support, we give a brief general description of the support, followed by the strengths, weaknesses, opportunities, and threats found from the perspective of systemic, systematic, and strategic sustainability work in organizations.

3.1.1 | UN's SDGs

The SDGs and Agenda 2030 were adopted by the UN on September 25, 2015. The UN resolution includes 17 overall goals:

1. End poverty in all its forms everywhere.
2. End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.
3. Ensure healthy lives and promote well-being for all at all ages.
4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
5. Achieve gender equality and empower all women and girls.
6. Ensure availability and sustainable management of water and sanitation for all.
7. Ensure access to affordable, reliable, sustainable, and modern energy for all.
8. Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all.
9. Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.
10. Reduce inequality within and among countries.
11. Make cities and human settlements inclusive, safe, resilient, and sustainable.
12. Ensure sustainable consumption and production patterns.
13. Take urgent action to combat climate change and its impacts.
14. Conserve and sustainably use the oceans, seas, and marine resources for sustainable development.
15. Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.
16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels.
17. Strengthen the means of implementation and revitalize the global partnership for sustainable development.

With these overall goals, there are 169 associated targets (UN 2015). The goals and targets are emphasized to be "integrated and indivisible" (UN 2015, 1). The resolution also

discusses *means of implementation* and *follow-up and review* on national, regional, and global levels (UN 2015).

3.1.1.1 | Strengths. The SDGs represent a fantastic political achievement. Leaders of almost all countries agreeing on these ambitious and attractive goals for a better world brings about a sense of hope among many people, which is highly beneficial also for sustainability work in organizations. It is a beautiful example of international collaboration and consensus work. Being facilitated and adopted by the UN, a body having the best of humanity in focus, promotes credibility and acceptance. Through skillful communication, and in their own right, the SDGs have received much attention and have boosted much enthusiasm and effort among companies, municipalities, and other organizations. The goals are set in a number of areas that are important to consider for sustainable development from a systemic perspective. Having such areas listed is beneficial for sustainability work in organizations. The goals prompt for significant change in industrial and societal practices already within a decade, which promotes a sense of urgency that in turn promotes a will to act among organizations.

3.1.1.2 | Weaknesses. The SDGs do not represent, and are not claimed by the UN to be, a science-based and operationally applicable definition of sustainability. Although leaning somewhat on scientific knowledge, the goals and targets more represent what could be politically agreed upon at the time of adoption than what is necessary and sufficient, in concrete operational terms, for sustainability from a scientific point of view. Weaknesses in formulations and in anchoring of goals and targets in scientific evidence have been pointed out (e.g., ICSU 2015). The goals bring attention to important areas, but as they are not derived from root causes of unsustainability (systemic flaws in society's basic design and operation), they do not provide much clarity to *why* we have problems in the highlighted areas. Thus, they give weak to no guidance for upstream problem-solving, redesign, and innovation. The narratives are not concrete enough to guide innovation that addresses the root causes of the problems. Examples are lacking guidance on how to address sustainability-related challenges with energy systems, transport systems, food systems, forestry, and chemicals. Not clarifying root causes also makes it difficult to avoid future problems in currently unknown problem areas. There is also significant overlap between goals, which hampers comprehension and complicates development of indicators and monitoring of progress in general, and since the guidance for follow-up and review is mainly given for the macro level, it is difficult to relate the SDGs to activities and indicators that are relevant to organizations' strategic, tactical, and operational needs. Furthermore, the goals do not come with any procedural support for how organizations could work in a systematic way with those needs, and it is not clarified how doing so proactively in a strategic way could be self-beneficial for the organization. Many calls have been made for improved means for implementation (e.g., ICSU 2017; Spangenberg 2017; Caiado et al. 2018). For a specific organization to identify further weaknesses from an SSD perspective, a question to ask would be: What sustainability-related aspects that are essential to *our* strategic transition cannot be found in the SDGs?

3.1.1.3 | Opportunities. Building on their strengths, we see great opportunity to improve the relevance and value of the SDGs by making them more operationally applicable in organizations. For example, the SDGs could be used to boost inspiration for vivid descriptions of attractive futures within the SPs in the organization's visioning work (A), the SDGs could be used as a list of problem areas to cross read against in the organization's problem assessment to see if the organization's view of challenges could be complemented (B), the SDGs could be used as inspiration in the organization's creation of actions (C) and likewise in the prioritization of actions and the related setting of intermediate goals in the organization's strategic plan (D). For a specific organization to identify opportunities with the SDGs from an SSD perspective, a question to ask would be: What could *we* add, learn, and take inspiration from among the SDGs to complete the aspects identified under *our* A, B, C, and D, respectively? Although the SSD approach (as described above) is robust, certain aspects may still be missed in creative processes in individual organizations and therefore input from the SDGs regarding specifics could be beneficial to add to the structure given by the ABCD procedure. This way it could be clarified and communicated how the actions and 2030 goals at the micro level contribute to the macrolevel SDGs for 2030, thereby allowing the organization to take part in a global movement without missing out on neither the full scope of sustainability nor its own strategic opportunities.

3.1.1.4 | Threats. We see some potential threats if the SDGs are not used together with a systemic, systematic, and strategic sustainability approach. For example, there is a risk that the power of change that organizations represent is not optimally utilized, which would likely mean that we will not achieve sustainability, nor the SDGs. This has happened with the Swedish Environmental Objectives. Two decades after their introduction, only one of the 16 objectives is deemed to be fulfilled, and for many objectives, there is a negative trend (Naturvårdsverket 2021). We argue that a significant reason for this is that many of these macrolevel targets are expressed in a narrative format that may seem inspirational to society but too vague for individual organizations to guide strategic and concrete action. We see a risk for a similar scenario for the SDGs, meaning that the initial enthusiasm and efforts seen among organizations could fade out and shift into confusion, frustration, and inaction, which would imply a loss of time and other resources for what needs to happen. The large number of goals and targets and the lack of procedural support for organizations for *how* to work with these in a systematic and strategic way, risk resulting in organizations "selecting" a few goals that "feel" most relevant, which is against the spirit of the UN resolution and risks resulting in suboptimized or counterproductive action. A related risk for suboptimization is if organizations base their investment strategies mainly on these politically and currently agreed upon SDGs and see them as "end-goals," rather than basing their investment strategies on what is needed for full sustainability from a scientific perspective.

3.1.2 | Planetary Boundaries

The Planetary Boundaries Concept (PBC) was introduced by Rockström et al. (2009) and updated by Steffen et al. (2015), Persson et al. (2022), Wang-Erlandsson et al. (2022), and

Richardson et al. (2023). It aims to outline a number of critical problem areas related to environmental sustainability and representative variables of these problem areas. It aims to specify numerical boundaries for these variables that would imply a "safe space for human development" (Rockström et al. 2009, 1). The current version includes the following problem areas:

1. Climate change.
2. Biosphere integrity.
3. Land-system change.
4. Freshwater change.
5. Biogeochemical flows.
6. Ocean acidification.
7. Atmospheric aerosol loading.
8. Stratospheric ozone depletion.
9. Novel entities.

The PBC relates to the concept of "tipping point," meaning a point beyond which the increase of the problem (variable) will be self-reinforcing. The intention is to provide a safety margin to such points. An extensive analysis of the PBC from an SSD perspective was given by Robèrt, Broman, and Basile (2013). Some main points from this and some updates are included below in the SWOT format.

3.1.2.1 | Strengths. The PBC represents a significant step forward for clarifying important human-driven environmental impacts from a systemic perspective and for attempting boundaries for these in concrete numerical terms. The selection of problem areas, representative variables, and the numerical boundaries are science-based. The numerical boundaries can be seen as a science-based partial definition of environmental sustainability. This is valuable, for example, for international discussions on global and regional environmental goals. Knowing about the listed problem areas is beneficial also for sustainability work in organizations. The concept and associated illustrations clearly display current problems and promote an understanding of their absolute and relative severity. Showing that we have already surpassed the estimated boundary for six of the nine variables (Richardson et al. 2023), meaning a significant risk of also passing tipping points, contributes to a sense of urgency that in turn can promote a will to act among organizations. The scientists behind the concept make continuous attempts to refine the estimates of current boundaries and the very idea of attempting to specify planetary boundaries serves as inspiration for finding estimates for planetary boundaries that are not yet identified. The concept has received much attention, serves as a "benchmark" for further scientific inquiry, and is well-known among companies, municipalities, and other organizations.

3.1.2.2 | Weaknesses. The PBC is insufficient in that it does not cover all potential environmental problem areas and for some of the included problem areas it can be questioned how meaningful it is to specify a single numerical boundary, such as for the category that the scientists behind the concept call "novel entities." This includes, for example, a huge number of human-invented chemicals. Attempts to quantify this boundary highlights the complexity of the task (Persson et al. 2022; Richardson et al. 2023). In addition, the PBC does not provide much clarity to *why* we have problems and approach or surpass boundaries in the selected problem areas (Robèrt, Broman, and Basile 2013). It does not clarify the systemic root causes of the problems it displays and, therefore, provides limited concrete guidance for upstream redesign-oriented problem-solving and innovation. This also makes it difficult to avoid future problems in currently unknown problem areas. Furthermore, the boundaries are given for the macro level and do not come with any support for relating activities and indicators that are relevant to organizations to these macro level boundaries. There is also overlap between the problem areas, for example, interrelations between climate change and land-system change, which complicates things further. "Quantifying interactions between boundaries remains a major challenge" (Richardson et al. 2023, 3). Finally, the PBC does not come with any procedural support for how organizations could work in a systematic way with the concept to generate plans for change, and it is not clarified how doing so proactively in a strategic way could be self-beneficial for the organization. For a specific organization to identify further weaknesses from an SSD perspective, a question to ask would be: What sustainability-related aspects that are essential to *our* strategic transition cannot be found in the PBC?

3.1.2.3 | Opportunities. Building on its strengths, we see great opportunity to improve the relevance and value of the PBC by making it more operationally applicable in organizations. For example, the PBC could be used to assist a systemic understanding as a basis for the organization's visioning work (A), to provide a list of problem areas to cross read against in the organization's problem assessment to readily get currently important problem areas on the table (B), and, most prominently, to support innovations (C) and prioritizations (D) of the organization's practices based on the severity of problems as clarified by the color-coded current status (see the diagram in Figure 2), including the speed of change of the variables in relation to the respective boundary. By acting on root causes of unsustainability, that is, eliminating the organization's contribution to society's violation of the SPs of the FSSD, the organization contributes to halting the increase of the problems in the problem areas included in the PBC (and other sustainability problems). This way it could be clarified and communicated how actions at the micro level contribute to solving the macrolevel problems highlighted in the PBC. As violations of the SPs explain all sustainability problems upstream in cause-effect chains, including the PBC-problems, there are two more major benefits with acting on SPs: (i) we do not need to await better estimates of numerical boundaries and more meaningful categories and (ii) we can avoid problems that we currently do not even know that we would get if the violation of the SPs would continue. For a specific organization to identify opportunities with the PBC from an SSD perspective, a question to ask would be: What could *we* add, learn, and take inspiration from in the PBC to complete the aspects identified under *our* A, B, C, and D, respectively? Although the SSD approach is robust, certain aspects may still be missed in creative processes in individual organizations and therefore input from the PBC regarding specifics could be beneficial to

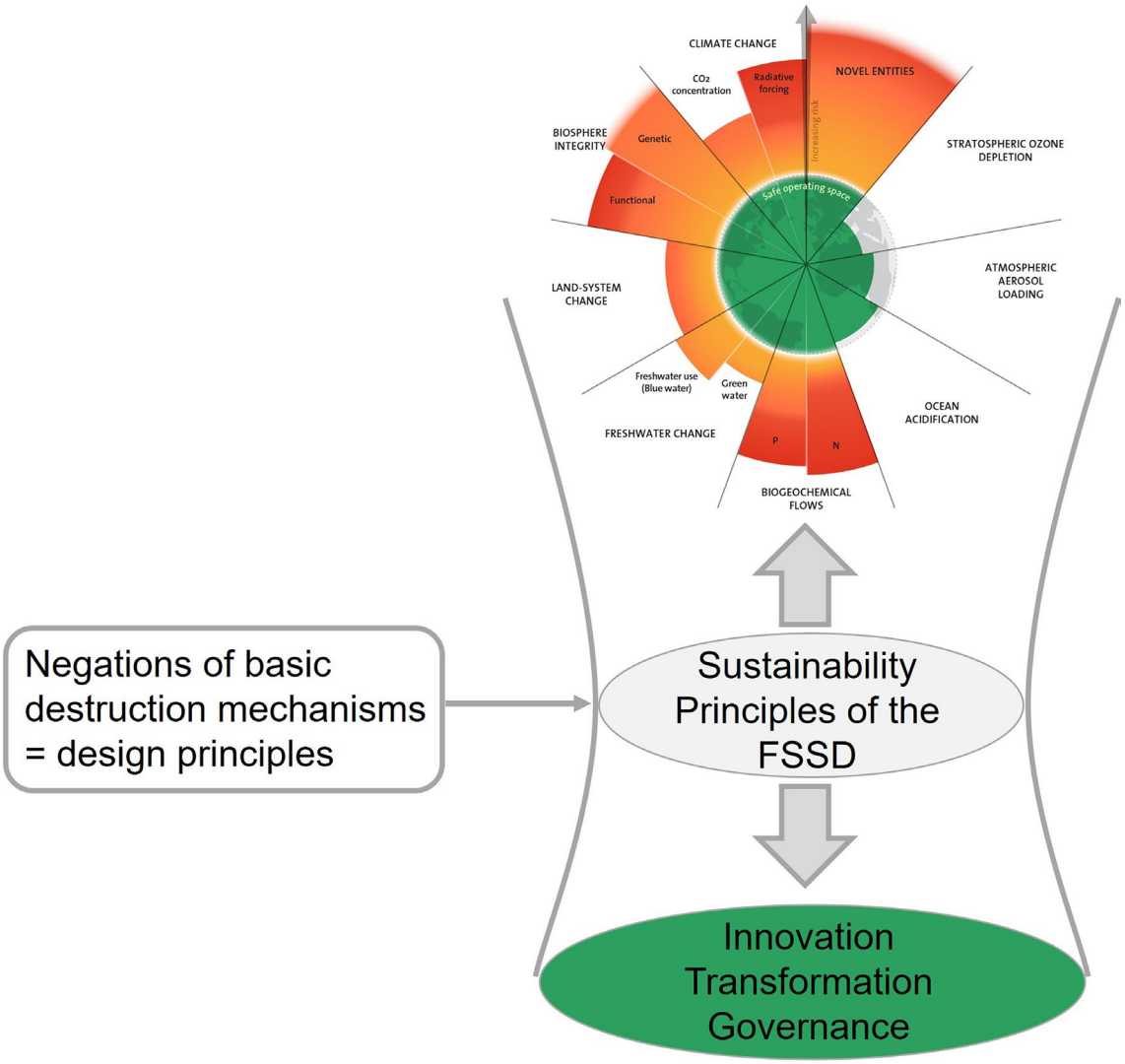

FIGURE 2 | Violations of the SPs of the FSSD are the root causes for planetary boundaries being approached and surpassed, and therefore, the SPs function as boundary conditions for sustainable visions and thus as principles guiding redesign toward sustainability. *Reproduced with permission from an image presented by Johan Rockström at the Future of Leadership Conference in Stockholm 2016. Planetary boundaries image in the upper part is reproduced with permission from the Stockholm Resilience Centre (*Licensed under CC BY-NC-ND-3.0*; Credit: Azote for Stockholm Resilience Centre, based on analysis in* Richardson et al. 2023).

add to the strategic structure given by the ABCD procedure. This way it could be clarified how the goals for the organization relate to the planetary boundaries, and thus, it could be clarified and communicated how the actions and goals at the microlevel contribute to respecting the macrolevel constraints.

The relation between the PBC and the SPs, and how they can be used together to guide innovation, transformation, and governance, is illustrated in Figure 2.

3.1.2.4 | **Threats.** We see some potential threats if the PBC is not used together with a systemic, systematic and strategic sustainability approach. For example, as with the SDGs, there is a risk that the power of change that organizations represent is not optimally utilized, which would likely mean that we will surpass boundaries further and surpass more boundaries. We see a risk that the initial enthusiasm among organizations could fade out and shift into confusion, frustration, and inaction when the difficulties of making sense of and use of the PBC at the organizational level becomes clear, which would imply a loss of time and other resources for what needs to happen. Also, even if we knew all problem areas and boundaries already today, there is a risk that much effort would be spent on trying to determine national and organizational "fair shares" within the estimated constraints and on trying to force compliance with this. Doing so would risk under-utilizing the power of enlightened self-interest of proactivity among organizations (e.g., McNall, Hershauer, and Basile 2011; Willard 2012; Robèrt and Broman 2017), which would risk the whole societal transition. This is not the way major shifts have ever taken place in history. Mechanical typewriters and calculators were not abandoned for computers because a "global emperor" decided so, and the burden of investing in new technologies was not "divided fairly" between nations and organizations. A focus on "fair shares" within planetary boundaries also risks getting us into suboptimal and counterproductive tragedy of the commons and prisoner's dilemma reasonings (Robèrt and Broman 2017). "Why should we

comply with our share if we cannot trust that others comply with their shares?" Such attitudes take significant energy away from strategically and competently redesigning one's operations toward compliance with the SPs. Besides harming competent and economically beneficial proactivity in individual organizations, it could also have serious negative impacts on international negotiations and policies.

3.1.3 | Circular Economy

As the name indicates, the core idea of circular economy (CE) is to promote circular flows of materials or material objects (in technical or biological systems) in ways that are economically beneficial for those involved in the activities. The purpose is to reduce waste and environmental impact (e.g., Lieder and Rashid 2016; Murray, Skene, and Haynes 2017). The concept can be seen to stem from and combine elements from concepts such as eco-efficiency, industrial symbiosis, industrial ecology, cradle to cradle, natural capitalism, and others. Several definitions exist. For example, Kirchherr, Reike, and Hekkert (2017) reviewed 114 definitions and claimed that the most employed definition among those is the following:

> A circular economy is an industrial system that is restorative or regenerative by intention and design. It replaces the 'end-of-life' concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models.
>
> (MacArthur 2013, 7)

In more recent evolutions, CE also includes strategies of *substitution* to be considered before circularity strategies are considered, as captured by, for example, the steps named by Potting et al. (2017) as *refuse* and *rethink*. Although building on concepts that have existed for long, CE has received much attention in the latest decade, not the least because of the skillful promotion of the concept by the Ellen MacArthur Foundation (MacArthur 2024).

3.1.3.1 | Strengths. In contrast to the SDGs and the PBC, CE is directly useful at the micro level, that is, directly useful for companies, municipalities, and other organizations. Circular solutions are beneficial in many cases and facilitating the identification and design of economically beneficial circular solutions is therefore certainly a significant strength of CE. This way, the power of change that organizations represent, which is so important for succeeding with the sustainability transition, is more likely to be utilized. CE has received much attention and has resulted in many beneficial initiatives among organizations.

3.1.3.2 | Weaknesses. A significant weakness of CE is that it does not include or relate to a science-based and operationally applicable definition of sustainability that clarifies root causes of unsustainability. Therefore, the concept does not facilitate a clear linkage between microlevel action and macrolevel sustainability, or in other words, it does not facilitate problem-solving and innovation from a sufficiently large systems perspective. We believe that this can explain calls for adopting a whole-systems approach to CE including redesigning also economic and social relations to achieve a balance in human–nature relationship, including the planetary scale (e.g., Kara et al. 2022). This weakness makes it difficult to find appropriate levels of recycling, for instance. To "recycle more than before" or "as much as possible" or "to save as much money as possible" is not necessarily sufficient or appropriate to stay within the constraints of the SPs, and hence not from a strategic business point of view on increasingly sustainability-driven markets (see the funnel metaphor above). Although substitution is included as a strategy to be considered in some versions of CE, there is not much support in the concept itself for determining when this is the most appropriate solution. Some materials in some applications are extremely difficult (technically and/or economically) to safeguard within the SPs, such as chlorofluorocarbons (CFCs) in consumer goods to mention but one example. Avoiding "toxic materials" does not suffice. CFCs are typically neither toxic nor bioaccumulative, but as persistent substances foreign to nature they come with a high risk of increasing systematically in concentration in nature also at low levels of leakages, that is, they come with a high risk of violating the second SP of the FSSD. Such materials should therefore be phased out rather than recycled in applications that cannot guarantee technically tight loops. There are also other consequences of the missing definition of full socioecological sustainability. To maintain sufficient assimilation capacity, climate regulation capacity, food production capacity, biological diversity, etcetera, it is essential to also improve society's "physical management" of productive areas on land and at sea. CE does not give much guidance here. There is also the whole realm of social sustainability that is weakly represented in CE (e.g., Murray, Skene, and Haynes 2017). Some considerations of social sustainability have started to enter CE applications (e.g., Kravchenko, Pigosso, and McAloone 2019) but as the concept does not include a solid definition of social sustainability either, it risks leading to "patching and repairing" rather than strategic action toward full socioecological sustainability. Also, CE does not come with any procedural support for how organizations could work strategically with the concept in combination with other sustainability supports, which we believe aggravates implementation and can explain observed gaps between words and actions and failures to address many socioecological, systemic implications of a circularity transition (e.g., Friant, Vermeulen, and Salomone 2021). For a specific organization to identify further weaknesses from an SSD perspective, a question to ask would be: What sustainability-related aspects that are essential to *our* strategic transition cannot be found in CE?

3.1.3.3 | Opportunities. With its obvious relevance from an organizational perspective, we see great opportunity to improve the value of CE and clarify its potential for global sustainability (i.e., to clarify the linkage between micro and macro levels) by using the concept together with a systemic, systematic, and strategic sustainability approach. For example, circular solutions could be part of vivid descriptions of attractive futures within the SPs in the organization's

visioning work (A). An SP analysis can also help the organization determine when a circular solution is not appropriate as the "end goal," but perhaps as an intermediate solution (C) that should be prioritized under certain conditions (D). CE thinking can also help clarify resource inefficiencies in the problem assessment (B). Using CE in an SSD context can also facilitate maximum utility by combining CE with other powerful sustainability supports in a coordinated way. For a specific organization to identify opportunities with CE from an SSD perspective, a question to ask would be: What could *we* add, learn, and take inspiration from in CE to complete the aspects identified under *our* A, B, C, and D, respectively? Although the SSD approach is robust, certain aspects may still be missed in creative processes in individual organizations and therefore input from CE regarding specifics could be beneficial to add to the strategic structure given by the ABCD procedure.

3.1.3.4 | Threats. Although substitution is an option in some versions of CE (e.g., Potting et al. 2017), there is generally a strong perceived emphasis on circularity and attempts at circular solutions also in cases where they are not necessarily appropriate from a systems perspective (e.g., Corvellec et al. 2020). This risks tying up resources that would be better used for other solutions. There is also a risk that the concept is misused to argue for solutions that might be economically beneficial for some actors in the short term but that are doubtful from a long-term sustainability point of view, such as using the circularity argument for spreading the current type of sewage-sludge on agricultural land. Another example is large-scale use of biofuels to phase out fossil fuels without understanding that this can only serve as an intermediate platform toward energy systems that fulfill the SPs together with all other sectors. Generally, the lack of a solid definition of full sustainability and procedural support for strategic planning and action for approaching it risk leading to suboptimal solutions and backlashes. This could include rebound effects (Baczyk et al. 2024). There is a risk that too much emphasis is put on introducing circularity in old practices, and that new significant innovations that have little or nothing to do with circular material flows are missed. The term itself is also somewhat misleading. Some versions of CE include considerations of substitutions and some versions of CE include social aspects to some extent without clarifying what is *circular* about those aspects. Furthermore, hopes have previously been put on "new types of economy": green economy, ecological economy, real cost economy, etcetera. CE is now the new economy that risks being seen as the silver bullet that will solve all problems. When this also fails, there is a risk that the initial enthusiasm and efforts seen among organizations could fade out and shift into confusion, frustration, and inaction, which would imply a loss of time and other resources for what needs to happen.

3.1.4 | Science-Based Targets

The SBTs initiative (SBTi) is a corporate organization describing SBTs as a clearly defined pathway for companies to reduce greenhouse gas emissions, helping prevent the worst impacts of climate change and future-proof business growth. SBT is an attempt to translate the planetary goals stipulated in the Paris Climate Agreement to organizations, with companies as the primary audience (SBT 2020). The basic idea is to set "greenhouse gas (GHG) emissions reduction targets that are aligned with reduction pathways for limiting global temperature rise to 1.5°C or well below 2°C compared to pre-industrial temperatures" (SBT 2020, 3). Different methods for setting SBTs exist but with the same intent of finding a company's "fair share" of the total emissions allowed according to global emissions reduction pathways. Key components of the methods are (i) the global carbon budget that keeps warming below 1.5°C or well below 2°C, (ii) an emissions scenario including the timing of emissions reductions, and (iii) an approach for allocating a share of the total budget to the company (SBT 2020).

3.1.4.1 | Strengths. The SBT approach is science-based in the sense that it aims to be in line with what the latest climate science deems necessary to meet the goals of the Paris Climate Agreement. It clearly aims to link the planetary and organizational scales for the climate challenge and can in that way raise awareness among organizations of their role in global climate change abatement and give an idea of what the organization needs to do as a minimum. This can drive innovation, improve credibility and reputation, and keep the organization ahead of public policy shifts. The targets can be seen as a science-based partial definition of environmental sustainability, although even more limited than the one that the PBC represents. The severity of climate change and how much that remains to be done become clearer when working with the SBT approach and this can contribute to a sense of urgency among organizations. The concept has received much attention and is well-known among organizations, and many have already signed up to apply the approach.

3.1.4.2 | Weaknesses. The SBT approach is focused only on climate change, which is an insufficient perspective even for solving the climate challenge, let alone for solving the whole sustainability challenge. The SBT approach also focuses on emissions and essentially omits other drivers of climate change (e.g., physical destruction of fertile land). Even what emissions reductions that should be accounted for is debated, as some types of accounted reductions might not result in real-world mitigation (e.g., Bjorn et al. 2022). When organizational and societal actors are not redesigning their whole operations to comply with all the SPs, they might, for instance, overestimate the potential of biofuels to replace fossil fuels, at the expense of reserving areas that need to be prioritized for biosphere integrity and biodiversity, including sustainable forestry and agriculture. All this risk leading to suboptimized actions. Also, the approach does not provide concrete guidance for upstream problem-solving and innovation and it generally does not clarify the economic dynamics of the sustainability challenge and related opportunities for organizations as elaborated on by, for example, Robèrt and Broman (2017). Finally, it does not come with any procedural support for how organizations could work strategically and gain from proactivity beyond "fair shares," which risks delaying the necessary change. For a specific organization to identify further weaknesses from an SSD perspective, a question to ask would be: What sustainability-related aspects that are essential to *our* strategic transition cannot be found in SBT?

3.1.4.3 | Opportunities. As with the SDGs and the PBC, we see an opportunity to improve the relevance and value of the SBT approach to organizations. For example, the SBT approach could be used for cross-reading in the organization's

problem assessment (B), generation of possible measures (C), and prioritization work (D) to get an idea of the magnitude in quantitative terms of the organization's contribution to the climate problem and a sense of a kind of "minimum pace" for the phase out of the organization's dependency on contributing to GHG emissions. It could also be used as a communication tool, among others, to disseminate progress in the organization's systemic, systematic, and strategic sustainability work. By acting on root causes of unsustainability, that is, eliminating the organization's contribution to society's violation of the SPs of the FSSD, the organization contributes to halting the increase of the climate problem (while not forgetting other sustainability problems). Reporting along the SBT protocol could be a way to clarify how actions at the micro level contribute to solving the macro level problem of climate change. For a specific organization to identify opportunities with SBT from an SSD perspective, a question to ask would be: What could *we* add, learn, and take inspiration from in the SBT approach to complete the aspects identified under *our* A, B, C, and D, respectively? Although the SSD approach is robust, certain aspects may still be missed in creative processes in individual organizations and therefore input from SBT regarding specifics could be beneficial to add to the strategic structure given by the ABCD procedure.

3.1.4.4 | Threats. We see some potential threats if the SBT approach is not used together with a systemic, systematic and strategic sustainability approach. For example, as with the other supports, there is a risk that the power of change that organizations represent is not optimally utilized, which would likely mean that we will not solve even the climate problem. Even in an SSD context, we find it problematic to use the SBT approach in the organization's visioning work (A) since that would risk resulting in misguided or lower than optimal ambitions. An example could be an overestimation in (A) of the potential of biofuels (see above). Even if that would not be the case, the idea of "fair shares" inherently builds on a notion that it would be economically beneficial to stay in the "fossil carbon economy" as long as possible, or at least as long as would be seen "fair." This mindset, not realizing the dynamics represented by the funnel metaphor (see above), risks underutilizing the power of enlightened self-interest of proactivity among organizations and nations to be relevant on more and more sustainability-driven markets (e.g., Robèrt and Broman 2017). As pointed out for the PBC, this is not the way major shifts have ever taken place in history. See the technology shift example given above and the highlighted risk of falling behind in the paradigm shift. With these risks, we also see a risk that the initial enthusiasm among organizations could fade out and shift into confusion, frustration, and inaction, which would imply a loss of time and other resources for what needs to happen.

3.2 | Generalization

Examples of questions that have inspired and guided the evolution of the FSSD (see also Section 2) are:

- What if it would be possible to find a limited number of basic mechanisms of destruction of ecological and social systems, upstream at the root of cause-effect chains, with the capacity to explain all sustainability-related impacts downstream? If so,
- What if it would be possible to use such mechanisms as exclusion criteria, that is, to use their negations as boundary conditions for the modeling of sustainable practices, goals and visions? If so,
- What if it would be possible to develop procedural support linked to such a definition of sustainability that is useful for strategic leadership, governance, and innovation and redesign toward such visions in all kinds of organizations, sectors, and across scales? If so,
- What if it would be possible to clarify the self-benefit for an individual actor of working proactively in this way, for example, by systematically and strategically managing risks, trade-offs, goal conflicts, innovation of value offers and other aspects of economic success? If so,
- What if it would be possible to put the answers to the above questions together into an overarching, unifying and practically applicable methodology (framework) for SSD?

The answers to these questions have arguably turned out to be "yes," as it has been possible to reach certain qualities of the definition of sustainability (necessary, sufficient, etc.; see Section 2) and of the procedural support (ABCD-logic, including a deeper understanding of the self-benefit of using it). This is based on extensive theoretical work and real-life testing, leading to successive refinements of the FSSD to ensure those qualities (Broman and Robèrt, 2017).

With such qualities, we argue that the extracted and combined features of the FSSD presented in Section 2 and illustrated in Figure 1 have provided a particularly useful core of the lens for the SWOT analyses in this study. It has been shown to respond to the need for a convening structure for sustainability knowledge, tools and other supports outlined in the first section of the introduction and it has specifically proven useful for clarifying the limitations and value of some of the supports exemplified in the second part of the introduction.

Based on the SWOT analyses of the studied examples of sustainability supports and considering the special theoretical and observed qualities of the FSSD (Broman and Robèrt 2017), we see no reason why the systemic, systematic, and strategic sustainability approach used in this study would not be applicable for organizations to analyze and improve the value of any sustainability support. Especially based on the "opportunities" parts, we suggest a generalization for how organizations could make better use of *any* sustainability support. Namely:

Use the SSD approach illustrated in Figure 1 *to create a customized strategic plan for the organization, and in doing so, use existing specific knowledge and specific sustainability supports* (*tools*, *methods*, etc.) *to support and enhance the organization's*:

- *Visioning work (A); for example, use tools for modeling, simulation, and visualization of visions within the SPs and draw from predefined sets of goals.*

- *Assessment of current challenges and assets in relation to moving toward the vision (B); for example, use tools for analyses and draw from predefined sets of problem areas.*
- *Creative work for generating possible actions for closing the gap to the vision (C); for example, use creativity tools and draw from knowledge of existing solutions.*
- *Prioritization of actions and clarification and communication of related intermediate goals in its created stepwise strategic plan (D); for example, use simulation tools and draw from estimates of urgency for known problems.*

This provides a means for the organization for structuring the search for, and the analysis, selection, combination and use of specific knowledge and specific tools, methods, frameworks, and other forms of support when creating tailor-made strategic transition plans. When an organization is elaborating its vision and strategy like this, its gap to full sustainability as well as what specific supports that are most relevant and useful for the specific organization for executing its strategy becomes clearer. This facilitates linkage between the organizational and planetary levels as well as effective and coordinated use of supplementary specific sustainability supports. Again, we argue that stepwise eliminating one's *contribution* to society's violation of the SPs and stepwise developing value offers to others wanting to go in the same direction is *the* core organizational design strategy to support global sustainability as well as the organization's own success. The own success partly comes from better and better positioning of the organization on the more and more sustainability-driven market (as illustrated by the funnel metaphor).

This way, we believe that the relevance and value of specific sustainability supports could be greatly improved from the perspective of individual organizations. Putting the specific supports into such a generic operational support should increase the value of the specific supports in the same way that an *operative system* in, say, a smartphone, increases the value of various *apps*. For example, it can help make sense and use of macrolevel goals such as the SDGs in the organization, and it can help connect microlevel tools such as CE to full global sustainability. This generic "operative system" also makes it possible for the specific sustainability apps to be used together, combining complementary strengths in an optimal way. As the iterative ABCD work goes on, more apps may be called for successively and can then be analyzed and added to the arsenal in the same way (see Figure 3).

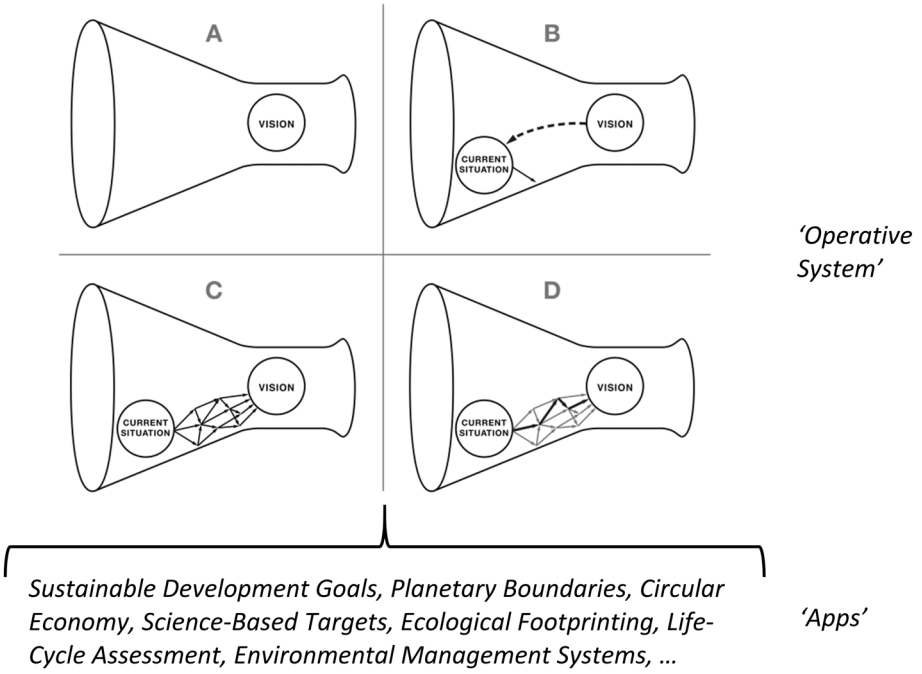

FIGURE 3 | Specific sustainability supports ("apps") put into a generic operational procedure ("operative system") for SSD. In brief, when an actor (e.g., organization) works with this operative system to produce an overall, customized strategic plan, the actor models a vision within the sustainability principles of the FSSD (A), captures current challenges and assets in relation to the vision (B), generates possible measures to close the gap to the vision (C), and prioritizes measures that ensure sufficient influx of resources to uphold the transition (D). In this, and in the following iterative execution and revision of the plan, cross-reading with existing apps can provide inspiration and learning and can complete the aspects identified under (A), (B), (C), and (D), respectively. Some apps are most useful in (A), some apps are most useful in (B), etcetera, and some apps are useful in all the phases and for execution (Broman and Robèrt 2017). This way, any sustainability support can contribute with its strengths and can be combined with other supports in an optimal way for the specific actor, while allowing the operative system to inform the actor to work *systemically* (using systems thinking, bridging disciplines, sectors, stakeholders and planetary-to-organizational scales to create system change), *systematically* (using well-defined, structured and consistent work procedures and leadership and innovation practices) and *strategically* (creating and executing economically viable, self-beneficial stepwise paths toward sustainability-framed visions). All this is in support of the actor's leadership, governance, innovation, and problem-solving toward the full scope of sustainability. *The upper part of the image is reproduced from* (Broman and Robèrt 2017).

4 | Discussion and Conclusion

In this study, we have suggested an approach for SWOT analysis of sustainability supports through an SSD-informed lens and used it for some significant examples of supports. We have also elaborated on how the presented SSD approach can give hands-on guidance for how sustainability supports in general can be used in an effective and coordinated way in support of systemic, systematic, and strategic transitions toward sustainability, in analogy with how an operative system in the IT-realm facilitates an effective and coordinated use of apps. The observed functionality of the SSD approach for both these purposes implies new, additional evidence for the previously indicated special qualities of the FSSD. Considering the quite different characteristics of the studied examples of sustainability supports, and considering the special theoretical and observed qualities of the FSSD (Broman and Robèrt 2017), we suggest that the presented approach should be generally applicable to analyze and improve the value of any sustainability support, including to guide collaboration among policymakers, business- and public sector leaders, and other relevant stakeholders toward effective and coordinated decision making and actions from a systemic, systematic, and strategic perspective, contributing to broad sustainability agendas, such as the Paris Agreement (solving climate problems without aggravating other problems) and Agenda 2030 (linking global goals and organizational goals). The latter comes not the least from the capability of the presented approach to bridge the planetary scale and the organizational scale.

To our knowledge, there is no other attempt to find a generic "operative system" for SSD with qualities underpinning the possibility to guide analysis, selection, development, combination, and coordinated use of other sustainability supports, and we have not found it feasible to use any of the other existing sustainability supports to analyze and guide effective and coordinated use of existing sustainability supports, which is natural as none of them has been developed for that purpose.

There are many reviews and overviews in the literature of the sustainability supports used as examples in this study. However, to our knowledge, there is no previous attempt at a SWOT analysis of those supports using the SSD-informed lens we have used here (as provided by the extracted and combined features of the FSSD presented in Section 2). In relation to previous FSSD-informed studies of sustainability supports (e.g., Holmberg et al. 1999; Robèrt et al. 2002; Korhonen 2004; MacDonald 2005; Robèrt, Broman, and Basile 2013; D' Amato and Korhonen 2021), the current study takes off more from the perspective of the operational ABCD procedure and provides more explicit guidance (as a generalized approach) for analyses as well as for effective and coordinated use of sustainability supports in practice in organizations. The current study is special in relation to previous FSSD-informed studies also because it reviews some new examples of sustainability supports having significant influence in the current sustainability discourse. Thus, the current study provides novelty in relation to reviews and overviews where the FSSD has not been used and in relation to previous FSSD-informed studies of sustainability supports.

An important part of the "operative system quality" comes from the qualities of the SPs. So, how can we be sure that the SPs are actually sufficient, also in terms of capturing possibly new impacts that may turn up in the future, that is, impacts that are not yet attributed to violation of any of the current SPs? For this to happen, there must be a basic mechanism of destruction that has been missed. The possibility for this cannot be excluded, but it is unlikely, at least for the ecological dimension. As the social SPs are newer and are so far presented as a zero hypothesis (Missimer, Robèrt, and Broman 2017a, 2017b), there is a somewhat higher risk that some basic mechanism for degrading essential aspects of the social system has been missed. In any case, some rephrasing of the SPs could happen after further testing in practical use. Indeed, as already said, the SPs have been refined before in several iterations so it may happen again. However, waiting for perfection is not an option given the urgency to transition to sustainability and not testing the SPs in practice would hamper their development. The previous refinements of the SPs have been possible because they have been used in real life in numerous cases (for examples see (Broman and Robèrt 2017) and further references given there). A major deliverable of the FSSD is the mindset as such with an open attitude to "learning by doing," including new versions of the framework itself. Major problems of not even attempting a framework of this kind include that: (i) goals are modeled without explicit and clear sustainability constraints and (ii) infrastructures and norms for cross-sector, interdisciplinary cooperation, with as robust, shared mental models as possible for systemic, systematic, and strategic sustainability work, are not searched for.

This type of "operative system" and using it broadly among organizations to analyze and coordinate other specific sustainability supports is in our opinion desperately needed. More and more tools, methods and other supports developed to tackle singular problems, will not suffice for solving the collective, fundamental sustainability challenge, and not even for solving singular challenges such as climate change. This is because the challenges, within and between problem areas, are interrelated. As mentioned, we need systemic, systematic and strategic approaches capable of bridging disciplines, sectors, and planetary-to-organizational scales to guide leadership, governance, innovation, and problem-solving (e.g., Whiteman, Walker, and Perego 2013; Bai et al. 2016; Dyllick and Muff 2016; Broman et al. 2017; Ranängen et al. 2018; Ordonez-Ponce, Clarke, and MacDonald 2021). This does not imply any controversy between different branches of sustainability science. On the contrary, the science including the metaphase mentioned in this article is about making better use of all other breakthroughs in sustainability science by bridging them better for strategic and operational use. And the more impact-oriented branches of sustainability science, for instance, have been and still are utterly important for many reasons, including to create and uphold a sense of urgency and a will to act as well as to support prioritizations of action. Application of specific tools, methods, and other forms of sustainability supports for specific challenges is also very valuable, and with the approach presented in this paper we believe this can be done more effectively. In fact, we argue that the presented approach addresses one of the most dangerously, still most commonly, missed pieces in public and private discourses on sustainability.

A potential limitation or challenge with the presented approach is that despite the methodological guidance given, the analysts likely need to have evolved some maturity in SSD thinking. This comes with experience, and gaining such maturity thus takes time. This could therefore constitute a bottleneck for a wide application of the presented approach. In future research, we will investigate if, and in that case how, artificial intelligence could assist faster learning and maturity development, or compensate for insufficiencies in SSD maturity of the analyst. With the conceptual foundation provided here, we will in future research also apply the presented approach to more examples of sustainability supports and in relation to specific case organizations across different industry sectors and stakeholders to gain more detailed feedback and comparative insights for further refinement and possibly sectorial adaptions.

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Appendix A

The principled definition of sustainability used in the FSSD (Broman and Robèrt 2017) reads:

In a sustainable society, nature is not subject to systematically increasing ...

1. ...*concentrations of substances extracted from the Earth's crust*. This means limited extraction and safeguarding so that concentrations of lithospheric substances do not increase systematically in the atmosphere, the oceans, the soil, or other parts of nature; for example, fossil carbon and metals;
2. ...*concentrations of substances produced by society*. This means conscious molecular design, limited production and safeguarding so that concentrations of societally produced molecules and nuclides do not increase systematically in the atmosphere, the oceans, the soil, or other parts of nature; for example, NOx and CFCs;
3. ...*degradation by physical means*. This means limited compaction, misplacement, displacement, and other forms of physical manipulation; for example, over-harvesting of forests and over-fishing;

and people are not subject to structural obstacles to...

4. ...*health*. This means that people are not exposed to social conditions that systematically undermine their possibilities to avoid injury and illness; physically, mentally, or emotionally; for example, by dangerous working conditions or insufficient rest from work;
5. ...*influence*. This means that people are not systematically hindered from participating in shaping the social systems they are part of; for example, by suppression of free speech or neglect of opinions;
6. ...*competence*. This means that people are not systematically hindered from learning and developing competence individually and together; for example, by obstacles to education or insufficient possibilities for personal development;
7. ...*impartiality*. This means that people are not systematically exposed to partial treatment; for example, by discrimination or unfair selection to job positions;
8. ...*meaning-making*. This means that people are not systematically hindered from creating individual meaning and co-creating common meaning; for example, by suppression of cultural expression or obstacles to co-creation of purposeful conditions.