




Innovations for the sustainability transformation

Conceptual cornerstones of the saguf working group INSIST

How can we understand, analyze and design innovations for the sustainability transformation? The newly formed saguf working group INSIST explores the links between sustainability, innovation and transformation in theoretical, empirical and practical respects. The focus is to move away from a technicist framework of ecological modernization to a more reflexive and inclusive concept of transformative innovation.

Basil Bornemann , Max Bergman , Olivier Ejderyan , Livia Fritz ,
Andreas Kläy, Patrick Wäger 

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Innovation has always been an important starting point for shaping sustainable development. In the Global North, technologies aimed mainly at efficiency or substitution of materials in resource-intensive economic sectors such as energy supply, industrial production, mobility and agriculture were to lead the greening of modernity. Concurrently, the Global South was to leapfrog developmental stages by employing technological innovation, thus avoiding the unsustainable path of industrialization. Whereas early discussions focused primarily on innovations related to

the development, utilization, and transfer of green technologies, a broader understanding of innovation, which included social innovations, ranging from new consumption practices to innovative governance arrangements, gradually took hold (Silvestre and Tircă 2019).

Sustainable innovations were also at the core of a long-standing working group of the Swiss Academic Society for Environmental Research and Ecology (saguf), which intensively studied the prerequisites, conditions, and consequences, as well as approaches and strategies, of sustainable



innovations in the context of the Swiss research and innovation system. It highlighted the predominance of a techno-economic paradigm that primarily fosters technological innovations as part of a competitive market environment and largely neglects significant contributions to a sustainability transition beyond marketable technologies. The working group is currently reconstituting itself with existing and new members, which promises a fruitful combination of accumulated knowledge and new impulses. While building on the group's previous work on sustainable innovations, it explicitly places its activities in a new theoretical and practical context, namely the scientific and political discourse on transformation.

Transformative innovations

Over the past decade, and especially since the UN's *2030 Agenda*, "transformation" has been increasingly used to characterize and orient societal change toward sustainability. The concept signals the need for all-encompassing societal change in the face of an escalating and increasingly visible socio-ecological crisis, manifesting in the threatening, even trespassing, of planetary boundaries and growing social inequalities and conflict (Sachs et al. 2019).

PD Dr. Basil Bornemann |
basil.bornemann@unibas.ch

Prof. Dr. Max Bergman | max.bergman@unibas.ch

beide: University of Basel | Department of
Social Sciences | Basel | Switzerland

Dr. Olivier Ejderyan | FiBL – Research Institute of
Organic Agriculture | Frick | Switzerland |
olivier.ejderyan@fibl.org

Dr. Livia Fritz | Aarhus University | School of
Business and Social Sciences | Herning | Denmark
and École Polytechnique Fédérale de Lausanne

(EPFL) | Laboratory on Human-Environment
Relations in Urban System (HERUS) | Lausanne |
Switzerland | livia.fritz@btech.au.dk

Andreas Kläy | University of Bern | Centre for
Development and Environment | Bern |
Switzerland | andreas.klaey@unibe.ch

Dr. Patrick Wäger | Empa | Technology and Society |
St. Gallen | Switzerland | patrick.waeger@empa.ch

saguf: saguf office | Dr. Xenia Junge | University of
Basel | Rheinsprung 21 | 4051 Basel | Switzerland |
saguf@unibas.ch | www.saguf.ch

This transformative turn in sustainability thinking raises new questions about the relationship between sustainability and innovation. It opens a new intellectual and practical territory for thinking about sustainability-oriented innovation. While innovation and related policy approaches have already undergone significant changes in the past (Schot and Steinmueller 2018), the paradigm of “sustainability transformation”, as Leach et al. (2012) argue, requires a radically new approach to innovation. What is needed is a wholesale change – not only in the technology and the systems and governance arrangements that produce it but also in the modes of innovation themselves. Similarly, Schot and Steinmueller (2018) call for a new framework and knowledge base for analyzing and designing transformative innovations (and related policies). Situating “innovation” in “sustainability transformation” brings new conceptual, analytical, and practical challenges, some of which we outline below:

1 Innovations that contribute to sustainable transformation are neither open-ended nor driven by general growth or progress imperatives, as in earlier innovation models (Leach et al. 2012, Schot and Steinmueller 2018). Instead, they require an active and managed shaping of “future expectations” of economic and social actors to create technologies and social practices that help bring and sustain current or future societal developments into a safe and just operating space (e.g., Carabias-Hütter and Haegeman 2013).

That space is not yet defined but it requires extensive and ongoing societal debate (incorporating scientific evidence) about where critical planetary boundaries lie and what notions of justice should apply. The contested nature of sustainability implies a political understanding of innovation that incorporates the multiple perspectives of different stakeholders in a deliberative process. Fagerberg (2018, p. 1573) argues that increasing social acceptance of the long-term goal of transforming the economy toward sustainability provides a “golden opportunity” to shape innovations accordingly.

2 While targeted in their basic orientation, transformative innovations are open regarding their specific technological and social development paths. Transformative innovations require a (quasi-) experimental trial-and-error mode since, from the outset, no pathway suitable and practical for addressing challenges in a particular context is known, let alone one that could be applicable on a large-scale and across a variety of contexts (Schot and Steinmueller 2018). Only through the accumulation of experience by various actors with different perspectives and priorities can viable paths be found. Such a model requires anticipating challenges, developing multiple, even opposing options and pathways, testing them in real-world social contexts, refining and adapting them based on co-creation and experience, and expanding and disseminating them.

3 The concept of transformation emphasizes the interconnectedness of short- and long-term societal developments. In the face of a socio-ecological crisis that is increasingly materializing in the present, transformative innovations should not only aim at long-term solutions to avert future crises (as was often the case in earlier approaches to sustainable innovation). Instead, they must also be able to provide answers to current crises. Conversely, times of crisis offer windows of opportunity to initiate and accelerate long-term innovation. In order to combine short- and long-term orientations into transformative innovations, societal visioning and scenario processes are suitable, within which short-term crisis-driven solutions are elicited with regard to their long-term implications (Leach et al. 2012).

4 The concept of transformation underscores the need for change not only within an existing social system, but also of the system itself. As numerous contributions show, the transformation of society toward sustainability is a highly complex matter involving various technologies, extensive structural change, and a large number of users within and between sectors. It concerns interlocking capabil-

ities, infrastructures, industry structures, products, regulations, user preferences, and cultural values (Fagerberg 2018, Schot and Steinmueller 2018). Sustainability-oriented innovations must therefore be designed, developed, implemented, analyzed, and evaluated in various domains, ranging from industrial production and consumption to education and training.

5 The systemic and interlocking nature of transformative change further requires an integrative approach. Innovations in one area must be considered in terms of their positive and negative consequences in other areas. Research and innovation policies focused on specific technologies, which still prevail in many fields, are insufficient and need to be complemented by a broader, more holistic approach that considers interactions of specific innovations in terms of their contribution to sustainable transformation. As activities in many policy areas – economy, health, transportation, energy, etc. – influence innovation processes, better coordination and alignment of policies are needed so that the different activities complement and do not counteract each other (Fagerberg 2018). The concept of leverage points can offer promising conceptual starting points for addressing the systemic nature of transformative innovations.

6 If transformation involves fundamental systemic change, we also need to consider approaches of exnovation, that is, the challenging and phasing out existing technologies or practices that counteract or prevent a sustainability transformation. Transformative innovation is not just about making new futures but also about unmaking the past and present that stand in the way of sustainability. This requires challenging and transforming the established path dependencies and the power relations that embed them (Schot and Steinmueller, 2018).

7 Transformation refers to a process that alternates between continuous and disruptive dynamics. Innovations must embrace such dynamics as: surfing on them, >

actively shaping, accelerating or dampening them. This is a particular challenge because innovations have their own temporality (Silvestre and Tîrcă 2019). However, the dynamics of innovations can be managed. The timing of innovations involves an awareness of the lock-in effects of innovations and dealing with them reflexively. This requires broadening the perspective from entrepreneurial niche dynamics to their embedding in societal dynamics (Mowery et al. 2010).

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8 In contrast to the transition concept (e.g., Geels 2011), which focuses on the vanguard role of technological pioneers often represented by a socioeconomic elite who shapes innovation in protected niches, transformation builds on a concept of innovation that is socially more inclusive. Moving away from a technicist framework of ecological modernization, concepts such as degrowth, social equality, and cohesion to “leave no one behind” come into focus. This not only implies a stronger focus on the distributional impacts of innovation, but it also requires greater consideration of how innovations are embedded in the diverse social contexts of actors affected. Transformative innovations involve multiple actors, including civil society and users, who can play a critical role in developing, shaping and disseminating innovations – not just one that articulates a demand to be met by business. Transformative innovations must be co-designed by stakeholders so that they fit into their lifeworld and form configurations that work “on the ground” (Schot and Steinmueller 2018).

Outlook: the saguf INSIST working group

Drawing on these conceptual cornerstones, the saguf working group on *Innovation for Sustainable Transformation (INSIST)* explores the links between sustainability,

innovation, and transformation in theoretical, empirical and practical respects. The aim is to take a broad view that explores motivations, practices, and implications relating to various actors beyond the “usual suspects”, that is, innovation and transformation activities that operate under the sustainability label. Thus, the focus is on different types of innovations and their implications for a sustainability transformation, some of which may not even be explicitly associated with sustain-

ability. We look at “organized,” “oriented,” or “emergent” innovations; at innovation that takes place between top-down (e.g., programmatic) or bottom-up (e.g., grassroots) dynamics; at sustainability innovations that bridge technical and social realms; and at the tensions between innovation and exnovation.

INSIST will explore successful cases that significantly contribute to a sustainability transformation “on the ground,” as judged by a variety of implicated actors in a specific environment (Bergman and Bergman 2022). By examining cases that have been successful in practice, we aim to elaborate further, enrich, and sharpen our conceptual framework for describing transformative innovations. One thrust here is to develop a set of criteria that enables a more differentiated assessment of the transformative impact of innovations. In this way, examples described as successful from a practical perspective can be further differentiated in terms of the type and quality of their success.

In addition to conceptual work and analyses of existing research on and practices of sustainability transformation, the working group will seek exchanges with actors from policy and practice who are involved in the concrete design of sustainability innovations at the societal and technological level or in the design of science,

research, and innovation policy as well as with other saguf working groups and scientists. We will challenge our own conceptual references to identify practical challenges of sustainability transformations.

Crucial focal areas of *INSIST* will be to increase its active membership by including individuals from diverse backgrounds, to organize activities that explore in a multi- and transdisciplinary manner the boundaries of innovation in the context of sustainability transformation, and to provide impulses on a sustainability transformation for academic and policy debates.

MORE INFORMATION:

https://saguf.ch/de/projects/innovation_for_sustainable_development

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