

# It is time for sustainability transformation

It is time to move beyond solving environmental problems one by one, to systemic sustainability transformations. Sustainability transformations are about rapidly fitting societal systems to match the carrying capacity of ecosystems. This is paramount for combating climate change and biodiversity loss and for securing a good future for generations to come. Making sustainability transformation happen needs everyone to join these efforts. The change should be based on research and it should be carried through in a just manner.

## Recommendations

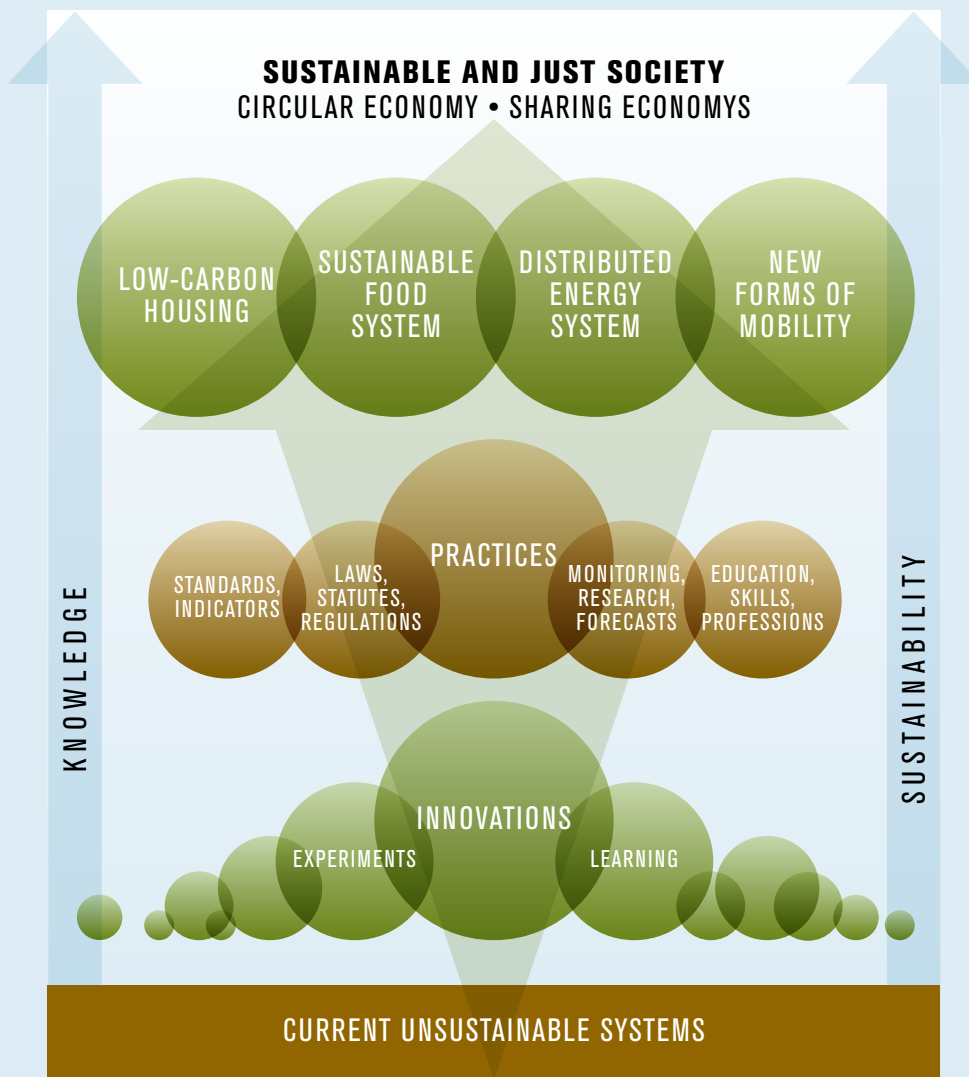
**Regulators** have a role in supporting experiments on sustainable technologies and practices, securing their entry to the market, and advancing their competitiveness against harmful technologies. Regulation can mainstream new technological and social innovations and ensure the fairness of sustainability transformation.

**Municipalities** can introduce sustainable solutions in their operations. They can create experimentation and collaboration opportunities for their enterprises and inhabitants, for sharing experiences and information.

**Companies** would benefit from developing and advancing new competitive business models, for example based on a circular economy or sharing economy. Sustainable solutions are often also cost-efficient.

**Agriculture and forestry actors** have excellent opportunities to harness ecosystem functions and develop nature-based solutions. It is important that the cost of ecologically sustainable production is transferred to product prices.

**We should all** question our old routines. Plant-based food, human-powered mobility, renting clothes and sharing goods both advance sustainability and increase our wellbeing, and end up costing less than our old practices. We can support each other in changing our lifestyles.



# Sustainability transformation is necessary

**Sustainability transformations mean rapid and broad changes in all societal systems, to secure ecological sustainability and human wellbeing. Sustainability transformations imply changes also in daily life. It is important to realize the changes in a fair way.**

Research and policy define sustainability transformations as profound reconfiguration of systems. Sustainability transition is a related concept that also highlights the disruption of existing systems in the delivery of societal services, such as energy, food or mobility<sup>1,2,3</sup>.

Sustainability transformations and transitions entail changes in practices at all levels: at the level of distinct experiments, in rules and regularities guiding action, and at the level of the whole society<sup>4,5</sup>. Decision-making and governance of sustainability transitions should strive for fairness<sup>6</sup>.

Although tackling environmental damage has been successful in many local settings, long-term monitoring shows that the overall system remains unsustainable. The world population has doubled during the last 50 years, and natural resource use has tripled. Natural resource use causes 90 percent of global biodiversity loss and water stress, and 50 percent of climate impacts<sup>7</sup>. A general sustainability transformation is a precondition for maintaining functioning societies on our planet also in the future.

## Societal systems need to change

**Traditionally environmental policy has targeted specific problems with tailored instruments, for example with emission caps or species protection. Although these single instruments have improved the state of the environment, or at least slowed its degradation, they have not achieved large enough changes in societal systems. Climate change, biodiversity loss, water stress and environmental chemicalization continue, but their connections to the institutions shaping production and consumption are not recognized adequately.**

Analyses of harmful and beneficial impacts at the level of societal systems often expose hidden, yet crucial, impact pathways.

For example, construction generates environmental impacts already when land is cleared. Construction requires large amounts of materials and energy. Some of the impacts are local, for example loss of nature on the site. Other impacts take place far from the construction site, for example when materials are imported from abroad.

Some of the impacts are long-lasting. For example, harmful substances might be released over decades when building materials corrode. In turn, wood construction can function as a carbon sink, even for centuries, and increase sustainability.

The use of buildings consumes energy for heat and electricity. Energy consumption depends on the energy efficiency of buildings. Electricity consumption is influenced by consumer choices, for example what appliances are chosen, how much they are used, and whether they are shared<sup>8,9</sup>.

Also the water consumption of the inhabitants has impacts. These impacts depend on the amount of water and detergents used, and for example of possible nutrient cycling and circular economy solutions in sewage treatment<sup>10</sup>.

The harmful impacts from the demolition waste generated in renovations and at the end of a building's lifecycle can be reduced by recycling materials<sup>11</sup>. This needs well-functioning treatment systems and markets for turning demolition waste into new products.

Although research has produced knowledge on complex chains of impacts, decision-makers, inhabitants or builders often do not recognize the impact pathways, and there are obstacles to systematically applying new knowledge in planning.

In the worst case, those who cause damage, are not responsible for the cost. Instead, the cost of repair and restoration have to be covered by public budgets. Therefore, the impact pathways need to be made visible. This allows better evaluation of the benefits, damages and costs, and a correct allocation of economic consequences.

New kinds of knowledge production are needed, in which actors anticipate, analyze and monitor new practices together<sup>5</sup>. For example, companies producing technological solutions can generate new knowledge and solutions together with inhabitants and researchers. It is important that all involved understand their specific role in producing and using new knowledge.

Also consumption practices need to change and new sustainable business models need to be created<sup>12</sup>. Policy needs to support experimentation and remove constraints on sustainability in ways that trigger changes at the system level<sup>3</sup>.

# Systems are interconnected

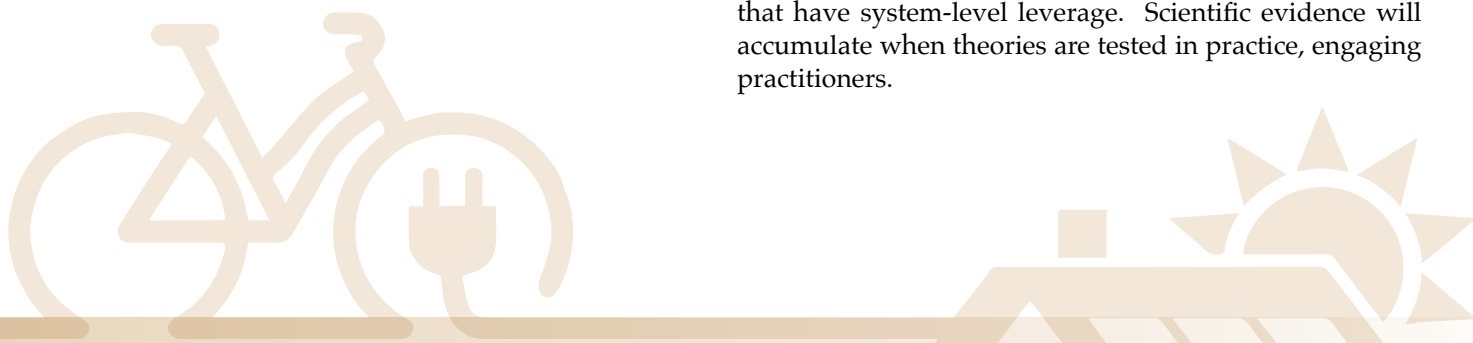
The systems of housing, energy production, mobility and food chains are interconnected. The food system connects with the energy system, as the production, processing and transport of food requires energy. Food production also influences the global carbon balance when land conversion to food production results in forest loss.

Systems are complex, and inter-connected through economy, technology, energy and material cycles. Societal systems ultimately depend on ecosystems, the natural systems.

The complex systemic interconnections challenge sustainability governance. Single disciplines or administrative silos are not well equipped to deal with sustainability challenges, or even change practices at a required pace.

Systemic sustainability transformations need all sectors and actors<sup>4</sup>. Identifying long interlinked chains of impacts requires cross-disciplinary research<sup>6</sup>.

Sustainability transformations need support from research. Knowledge producers should collaborate with knowledge users who are operating in the systems. This helps in channeling change and research to those practices that have system-level leverage. Scientific evidence will accumulate when theories are tested in practice, engaging practitioners.



**Solutions enabling sustainability transformation will eventually change the entire society. Research supports this change. Electrification of mobility as an example.**

## 1. NEW INNOVATIONS AND DIVERSE EXPERIMENTS TRIGGER SUSTAINABILITY TRANSFORMATIONS

Electrification of transport advances, electric cars, bikes and scooters take off.

New forms of mobility emerge, including car sharing, autonomous vehicle and drones for freight.

Alongside new technologies, new services emerge, such as mobility as a service. Owning vehicles is not necessary anymore, which saves natural resources.

## 2. INNOVATIONS SCALE UP AS TECHNOLOGY, RULES, PRACTICES AND PROFESSIONS EVOLVE

Battery technology and charging infrastructure develop.

Rules, subsidies and tax conditions for modes of transport change to support new modes of transport.

Oil-based mobility is phased out in a way that allows the businesses and underprivileged groups to adapt to the change.

## 3. THE SUSTAINABILITY TRANSFORMATION ADVANCES IN SYSTEMS, AND THE ENTIRE SOCIETY CHANGES

Distributed energy production is reinforced if the electricity in the car batteries can be directed to other uses.

Shared mobility can accustomize people to sharing also other resources, such as empty rooms and spaces.

Lower numbers of private cars free up land for other uses.

WHAT HAPPENS?

THE ROLE OF RESEARCH

Produce technological, social and governance innovations

Assess the sustainability of innovations, for example the positive and negative impacts of energy sources and raw-materials, and the sustainability of circular economy solutions

Support the aggregation and diffusion of the best solutions

Foresee changes and identify barriers to change

Establish a credible basis for standards and targets

Anticipate impact pathways, for example the challenges in recycling batteries in the electrification of mobility

Help understand over-arching developments in society and foresee their changes

Support the replication, up-scaling and diffusion of sustainable and feasible solutions from one system to another

Identify society-level sustainability challenges

# Sustainability transformations require change in practices

**Sustainability** transformations mean rapid and broad changes in all societal systems, to secure ecological sustainability and human wellbeing.

**Changes** in our thinking, practices and policies are a precondition for sustainability transformations. They require ecologically, socially and economically bold changes that will fundamentally alter our society. In sustainability transfor-

mations we need to ensure that no one is left behind.

**Sustainability** transformation should be promoted through coherent predictable policies, that set a sequence for phasing out wasteful and polluting technologies and practices. To ensure just change, companies and citizens should have access to compensation or support for reorientation during the transition phase.

**Ideally**, decision-making is more legitimate and impactful when the issues are analyzed holistically at a system-level and when decisions are based on evidence. Generating and transferring knowledge as well as communication and collaboration are key when sustainable solutions are scaled up and functioning solutions and practices are transferred to other systems.

## Transformation is called for

UN policies see sustainability transformations as essential. The UN has set sustainable Development Goals from the Agenda 2030 that originates in the United Nations Conference on Environment and Development in 1992. Science-based entry-points and levers for a sustainability transformation were identified in a Global Sustainable Development Report (GSDR) in 2019. All assessments addressing UN environmental goals emphasize the necessity of sustainability transformations. The European Union has taken just sustainability transformation as its starting point for success. The EU Commission published the European Green Deal in 2019, with the aim to transform Europe into a climate neutral green economy for the benefit of the whole EU.

**Six paths towards sustainability: a toolkit to promote a systemic transformation towards sustainable development in Finland** (kestavyyspaneeli.fi)  
**THE 17 GOALS: Sustainable Development** (un.org)  
**GSDR 2019: Sustainable Development Knowledge Platform** (un.org)  
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