

Preface

This work has been motivated by the quest to better understand how industrialized countries can prosper *and* decisively decrease CO₂ emissions at the same time.

We know that profound human behavior change is crucial for reaching critical CO₂ emission targets in time to avoid irreversible climate change. Behavior change is facilitated/hindered by technology, infrastructures, formal and informal norms. Therefore, the widespread use of eco-technologies is seen as a promising approach for an effective climate change mitigation strategy. However, the ubiquity of fossil-based technologies in our socio-technical lifestyles makes it hard to replace them with eco-technologies. In addition, the decision-making process concerning the choices of (eco-)technologies takes place in a self-organized manner in a fragmented context. Therefore, the linear innovation model, as it was exemplarily applied in the Manhattan project for the application of nuclear technologies in World War II, does not provide adequate guidance for the governance of technology change towards green economies. Nevertheless, the linear innovation model is still dominant in the thinking of many leading innovation and technology researchers, managers, and policy makers.

Only recently, actors and research institutes have started to explore different approaches that include stakeholder dialogues with national and local authorities, utilities, private entrepreneurs, associations, and citizens, in Switzerland specifically. The assumptions behind these joint efforts or the characteristics are often implicit, not reflected or communicated. The logic why, how, and when the new approach should work is not transparent. Likewise, the most important governance principles of such systemic governance approaches are less clear. Who should be responsible/accountable for such joint efforts? Who should be the captains that navigate the endeavor through the cliffs of power plays and acceptance problems if social and private benefits do not fully overlap? Who should be the entrepreneurs that manage trade-offs between investments made today and returns gained the day after tomorrow?

While these social experiments serve as an alternative innovation model for eco-innovation or socio-technical transition towards sustainability, the causal effects in society and outcomes regarding emission mitigation are hard to analyze

with traditional research approaches. Linear regression models, linear optimization models, or narrative explanations do have limitations for analyzing the dynamics of socio-technical transition experiments. However, simulation modeling, a young approach in social science, is most promising for eliciting and testing causal assumption about acting processes and the impact of socio-technical behavior change. But in the innovation literature, there are only few articles that provide piecewise knowledge or know-how about simulation approaches on socio-technical transitions. Comprehensive and well-tailored information about simulation modeling of socio-technical transitions is missing.

Therefore, in this book we provide a rich description of theoretical grounds, methods, and case studies that should support ambitious innovation researchers, analysts, or strategic advisers as well as novice researchers in their simulation modeling endeavors on socio-technical transition. In addition, a summary about most promising governance and management principles has been prepared.

The book is the product of an interdisciplinary research group of 13 researchers including economists, psychologists, physicists, chemists, and geographers. They all have been fascinated by the power of simulation modeling for better understanding the underlying processes of socio-technical transitions and their impact. They are the authors and coauthors of single chapters. In several cases, the reported research was part of doctoral theses, but no single researcher could have fulfilled one research task alone. Ongoing reflection and lively discussion between different disciplines and perspectives have been most important for a well-founded and validated research outcome.

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