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Mattia Martini • Rick Hölsgens • Rafael Popper  
Editors

# Governance and Management of Sustainable Innovation

Learning from Experience to Shape the Future

 Springer

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# Foreword

*There was a man in our town and he was wondrous wise,  
He jumped into a bramble bush—and scratched out both his eyes;  
And when he found what he had done, with all his might and main  
He jumped into the bramble bush—and scratched them in again.*

Old English Nursery Rhyme, origins uncertain

I have been quoting this rhyme for some decades; I find that it resonates with several important aspects of our social and ecological predicament, our civilisational dilemma. It suggests that sometimes the solution to a problem may be, at least in part, a matter of repeating the very behaviour that has caused the problem. Repeating precisely the same behaviour may very well intensify the problem, of course. But sometimes a revision of the behaviour, informed by an understanding of how the problem was caused in the first place, can help to address the problem, if not completely restore matters to their earlier state. This book, *Governance and Management of Sustainable Innovation*, contributes to this mission.

Over two centuries, more and more of the (growing) human population has been drawn into industrial ways of life. Whether we work in the classic industrial sectors or are mainly users of the products of these sectors, our patterns of production and consumption have been, and are still being, transformed through the application of technological and organisational innovations. This ‘bramble bush’ can be seen as scratching out our eyes in two senses. First, we can see our jumping into the process of transformation without much vision of, or concern for, the enormous impacts that we would be having on the natural world. The environmental regulation of business and household activity has a long history, though in general the focus was on preventing a local nuisance. The world was assumed to be so vast that our consumption and destruction of resources (including depletion of geological resources, pollution of water, land and air, and loss of biodiversity) was rarely thought of as a global or even national problem. Jevons’ *The Coal Question*, written in the middle of the nineteenth century (published 1865), did warn of catastrophic effect that the exhaustion of coal mines would have. But continuing exploitation of coal, and the realisation that other fossil fuels could be even more effective sources of power,

seemed evidence of almost limitless natural resources. It would be another century before concerns about *The Limits to Growth* (published 1972) regained a place on the agenda, and even that has been highly contested over much of the last half-century.

The second interpretation of the nursery rhyme stems from our growing awareness that the assumption that we could ignore environmental ‘externalities’, as if we lived in a limitless world, was wrong. Now it is not our eyes that are being scratched out—if anything we have gained more clarity in our vision. It is human civilisation itself that is threatened with being scratched out, by the growing climate emergency (let alone numerous other challenges to our food, health, and water securities). We have a clearer view of the risks associated with persisting with current modes of production and consumption—global heating and its consequences for agriculture, sea levels, and many ecosystems services. Additionally, there are many uncertainties associated with possible ‘tipping points’ that might trigger collapses and possibly set off chains of highly negative wild card events. We cannot reliably estimate the likelihoods of such events, but we do know enough to warrant a good deal of caution.

Yet we cannot simply abandon our knowledge and revert to preindustrial ways of life. The global population is at levels far above those that preindustrial economies could support. It would be disastrous to relinquish many of our technological and organisational innovations, even if we can envisage ways in which they can be improved. The argument that underpins the present volume, and the efforts of a growing number of activists and researchers—and business leaders and policymakers—around the world, is not that we should abandon innovation and focus on reducing demand and living ‘simpler’ lives. Apart from anything else, even if enough of the public were prepared to make the necessary changes, there is limited scope for cutting living standards in poorer parts of the world—and less equity in this.

The argument that is gaining traction now is that innovation has to be moved onto a new trajectory. This is more than just hoping for ‘tech fixes’, breakthroughs that could solve problems of the underavailability of energy and the overproduction of greenhouse gases in a flash. There are ways of confronting problems with, for example, large-scale roll-out of renewable energy systems and tree planting initiatives (though many of these require both time and extensive organisational change), but these are not ‘fixes’ that will make problems go away. Changes in innovation policies, strategies, and institutional frameworks (‘innovation ecosystems’) are required to establish new trajectories for technological and organisational change. These trajectories are ones that point in much more sustainable directions, where environmental criteria are built into decisions about new ways of doing things. In terms of the nursery rhyme metaphor, we need a new vision for the bramble bush. Otherwise, there is no way that future generations will view us as being ‘wondrous wise’. The wonder will be that our knowledge was applied so blindly: *There was a man in our town, he was a wondrous fool.*

The authors represented in *Governance and Management of Sustainable Innovation* do not claim unique wisdom, nor to have all the answers. Indeed, that is a

strength of their contributions, for several reasons. It is an invitation to further development of the ideas, to further exploration and innovation from activists, researchers, and practitioners of all kinds. It recognises the need for numerous initiatives to be taken, on many scales, with many engaged constituents. And it avoids the trap of assuming that change can be smooth and linear, whereas in practice it is often bumpy and winding. It is not like plunging into a bramble bush—it is more like trying to find a way through a forest. It is practically inevitable that major initiatives will have unintended consequences, and while some of these may be synergistic and reinforce and embed desired impacts, some are quite likely to subvert these goals. This is one factor behind the disappointment frequently associated with scaling up of innovations, when something that seemed so promising as a pilot or small-scale initiative turns out to be far less effective when implemented on a larger scale. One of the contributions of this book is to point us towards the need to monitor innovative efforts and towards ways of assessing their contributions to achieving sustainable ways of life.

*Governance and Management of Sustainable Innovation* thus addresses critical questions. What is sustainable innovation? What are the innovation processes that can support the transition to more sustainable modes of production and consumption, and how are various actors, institutions, and practices involved? What are the resulting innovations, and how can we assess their contributions? What policies and strategies are involved, how are they implemented with respect to different types of innovation, and how are different constituencies involved in the co-creation of new routines? How can stakeholders (and their knowledge) be mobilised, and what can the role be of future-oriented narratives in establishing more alignment of action and visions across communities?

These are far more than academic questions, even though we sometimes need to employ elaborate methods of analysis to address them. (Despite the claims that we have entered a ‘post-truth’ era, expertise is required, including expert understanding of social and organisational affairs as well as deep knowledge of engineering, ecology, and the like.) Translating the messages that arise from these analyses is vital. This is bound to be a matter of practical engagement in particular concrete instances, when the relevance of the concepts and assessments becomes starkly clear. In effect, this means not just painting a picture of the bramble bush, or vividly warning about thorns. It involves demonstrating what it involves to re-enter the bramble bush with eyes wide open—what tools may be needed to avoid getting cut, entangled, and blinded.

The bramble bush is an imperfect metaphor, especially because it concerns a single man, and we are addressing problems that involve collaborative action and social innovation. Songs and rhymes are sometimes used to coordinate collective action. One nursery rhyme is rather ominous in this respect—‘a-tishoo, a-tishoo, we all fall down’ is redolent of collective catastrophe and is generally supposed to refer to one of the plagues that struck medieval Europe. Work songs, such as sea shanties, accompany and sometimes synchronise (and add some fun to?) activities. The success of innovations may require their routines to be socially and aesthetically rewarding, though collective songs may not be in order. What will be of value are

narratives that can tell us about the process of creating constituencies around both the processes of creating sustainable innovation and the ongoing implementation and elaboration of such innovations. These narratives are much more like stories than simple rhymes. They may involve both case studies of actual experiences and scenarios explicating life within possible sustainable futures. They may be tailored to different audiences—and indeed, these, too, can be co-created with their ‘users’.

To summarise: a sustainable future requires sustainable innovation; action for sustainable innovation requires sustainable narratives of how and why such innovation is created and co-created. *Governance and Management of Sustainable Innovation* provides necessary parts of the foundation for such narratives and the action that they inform.

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Ian Miles

# Preface

Innovation is a key driver of societal progress in industrialised economies, especially in the management of imminent changes and uncertainties shaping the present and the future. In order to address the grand societal challenges of climate change, resource availability and environmental pollution, sustainability should be the focal point of the innovation process. Focusing innovative efforts towards sustainability goals, however, is still far from common practice as the concept of innovation tends to be surmounted with the notion of economic progress and the growth of welfare, rather than societal well-being.

Sustainable Innovation (SI) is defined as “*any incremental or radical change in a socio-technical system that leads to positive environmental, economic and social transformations without compromising the needs, welfare and wellbeing of current and future generations*” (Popper et al., 2016, see also Chap. 1). Given its multidimensional nature, SI involves different actors and interests; consequently, the active engagement of multiple stakeholders represents one of the main critical issues for the purpose of managing sustainable innovation. This is also true in the case of the formulation of SI-related policies and programmes, in which public participation, including citizens and civil society organisations, improves both the democratic legitimacy as well as the impacts realised through the implementation of these policies. Due to the complexity and ambiguity of sustainable development, the need for, and the interest in, developing evidence and knowledge about the management and governance of sustainable innovations and SI-related policies become apparent.

The book “*Governance and Management of Sustainable Innovation: Learning from Experience to Shape the Future*” is intended to contribute to this debate by sharing the results of a thorough desk and action research produced during the implementation of the European Union (EU) project “Public Participation in Developing a Common Framework for the Assessment and Management of Sustainable Innovation” (known by its short name: CASI), which was funded through the Seventh Framework Programme (grant agreement number 612113).

The CASI project was proposed as a response to one of the seven grand societal challenges set out in the Horizon 2020 programme of the European Union, namely “*Climate action, environment, resource efficiency and raw materials*” (known in EU circles as Societal Challenge 5 or SC5). It represented an EU-wide cross-sectoral partnership on innovation-related issues and considered not only the impacts of social and technological innovation but also other types, as well as the roles and interests of actors involved in the innovation process. A key ambition of the project was to develop a coherent methodology for the assessment and management of sustainable innovation practices, based on a sound conceptual framework and a shared understanding of sustainability in innovation, among a wide range of stakeholders (see also the project description on the CASI website, and Chap. 1 by Popper et al.).

Through a process of mapping sustainable innovations across Europe, practices representing unique social and technological innovations have been considered to study specific factors of, as well as consequences for, sustainability challenges with regards to social and business-oriented challenges. The CASI project provided opportunities and various entrance points for stakeholders to participate in debates on sustainable innovation, as well as on policy developments that ensured opportunities for a continuous and systematic assessment and management of SI initiatives.

CASI emphasised and enabled multi-stakeholders dialogue and participation by relying on highly participatory methods of citizen engagement (see especially Chap. 5 by Repo et al.). Based on citizen’s input and results from CASI’s internal analyses, EU-wide policy recommendations have been developed with the ambition to improve the integration of sustainability and innovation support actions for addressing the underlying issues embedded into Societal Challenge 5.<sup>1</sup>

The 19-partner consortium of the CASI project covered 12 EU Member States, while some additional 16 EU countries were represented by an extended network of national correspondents or experts who provided relevant inputs to the project.

Building on the work carried out during the CASI project and the multidisciplinary background of its contributors, this book aims to provide evidence, insights and reflection related to specific issues of governance and management of SI, which are addressed through the application of a common framework, using a multilevel and multi-stakeholder approach to sustainable innovation analysis. The CASI Framework (known as CASI-F) is used for the assessment and management of sustainability-oriented innovations, policies and aspirations of citizens. The Framework was developed with empirical evidence from an extensive, comprehensive and highly inductive study of more than 500 SI initiatives and lessons learned from stakeholders’ mobilisation and mutual learning activities.

The idea of this book comes from the growing need to compile, analyse and add value to the lessons learned from the development and implementation of the conceptual and methodological framework (CASI-F). A valuable contribution to the knowledge of this book is the way the authors build on selected empirical studies

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<sup>1</sup>See <http://www.futuresdiamond.com/casi2020/about/description/>

that originated from CASI-F applications in order to provide a systematic and interconnected set of approaches, insights and lessons, which complement and enrich the academic literature in the field of sustainability, as well as SI assessment and management. Overall, the results of the empirical studies were supported by a systematic use of foresight and forward-looking action research combining evidence, expertise, interaction and creativity-based approaches.

Compared to previous efforts to explore SI concepts, this contribution proposes a more methodological and practical approach, by focusing on why and how the quadruple helix of SI actors (i.e. government, business, civil society and research and education stakeholders as the main players in the innovation process), are increasingly involved in the assessment and management of sustainable innovation. Furthermore, the CASI-F driven mobilisation and mutual learning (MML) process helped to promote the incorporation of science in society by integrating multiple sources of knowledge and including multi-stakeholder perspectives (including citizens and sustainability experts) into the assessment of critical issues, and by advancing and incorporating scientific knowledge and innovative ideas from practice, and vice versa; thus enhancing the management of sustainable innovations that embraces societal concerns and needs.

This collective book is composed of ten chapters and structured around three main parts.

The first part focuses on the presentation of the conceptual framework and the theoretical context of SI, which provides a foundation for the remaining parts, and serves as a tangible illustration of how the empirical data was collected through the application of the CASI-F methodological framework.

*Rafael Popper, Monika Popper and Guillermo Velasco's* chapter sets the scene for the book by introducing the CASI Framework—a systematic five-step approach for the assessment and management of sustainable innovation (CASI-F)—the key components of which are used throughout the book. The authors also present working definitions of SI and lay out basic principles of multilevel perspectives and transitions, mobilisation and mutual learning, as well as multi-systemic assessment and management, all of which are further explored in the subsequent chapters. The chapter describes the final CASI-F methodology and associated protocols and tools (i.e. platform) while demonstrating the need for such an approach and the framing rationales and drivers that led to the development of the Framework. The chapter also offers a rich set of practical managerial lessons resulting from the empirical application of CASI-F, followed by an overview of CASI-F applications and its possible evolution. It concludes with some reflections on the authors' approach to learn from experience to shape the future.

*Aleš Lipnik and Maja Cergol Lipnik's* chapter explores the topic of SI by offering a “panoramic overview”. It provides newcomers with relevant information about (sustainable) innovation and related concepts. The chapter also aims to help the reader become familiar with major SI priorities at both European and global levels (e.g. by listing the United Nations Sustainable Development Goals). This is presented through a review of the mainstream literature on the definitions of

innovations with a specific focus on SI, and overviewing the development of the concept of eco-innovation into the CASI definition of sustainable innovation.

Part I concludes with a chapter by *Rick Hölsgens* and *Jürgen Schultze* introducing the seven types of sustainable innovation that have been mapped and studied within the CASI project. The chapter then focuses on the role of social innovations for sustainability. Building on examples from CASI and beyond, the authors demonstrate the importance of social innovations for the transition towards sustainability from the following two angles: (1) by altering social practices; and (2) by introducing novel ways of working and of collaborating. In their latter role, socially innovative initiatives can contribute to the transition to sustainability by promoting new methods for co-creation and consensus-based innovation, and new approaches to planning and policymaking that can lead to more sustainable products, practices and services.

The second part of the book focuses on the participatory governance of SI as it highlights SI-related priorities and the role of public engagement in forthcoming SI activities. In addition to the evidence-based analysis, innovative methodologies for policymakers emerged from the mapping of SI policies at the EU, national and local levels, as well as from the visions of citizens about sustainable futures.

*Mattia Martini*, *Elisabetta Marafioti* and *Monica Carminat*'s chapter explores how different configurations of stakeholder engagement influence the generation of sustainable innovations. By assessing a sample of agro-food Italian companies, the study identifies different SI strategies and explores the role of cultural and managerial attributes related to stakeholder engagement in supporting the development of SI strategies.

The chapter by *Petteri Repo*, *Kaisa Matschoss*, *Bjørn Bedsted*, *Zoya Damianova* and *Ventseslav Kozarev* identifies shared and specific topics in visions on sustainable futures, which were co-authored by citizens in connection to CASI and other two European projects (CIVISTI and CIMULACT). The chapter, in particular, reviews how European citizens envision desirable and sustainable futures by analysing a total of 298 visions. The authors identify how people's agendas for sustainable futures are expressed in the examined visions and reveal 20 identified agendas. The chapter further examines how the citizens' priorities relate to sustainable innovation.

Part II concludes with a chapter by *Benedetta Trivellato*, *Monica Carminati* and *Mattia Martini* that looks into a case of sustainable innovation implemented by the public sector to provide a better understanding of the dynamics, which allow the innovative process to benefit from stakeholders' contribution. The study shows that sustainable innovation in the public context may be seen as the result of a stakeholder co-creation process involving the main innovation promoter and its internal and external stakeholders. Both types of stakeholders are found to be involved in a collaboration process that fosters knowledge mobilisation and, in turn, is reinforced and fuelled by it.

The third part of the book investigates lessons learned from the management of SI, drawing attention to SI-related critical issues (barriers, drivers, opportunities and threats), management actions, dimensions and key aspects linked to the most relevant phases of the innovation process. The contributions for an effective

management of SI come from the comparison and assessment of SI cases, starting from those mapped and stored in the CASIPEDIA platform (i.e. a web-based set of protocols and tools supporting CASI-F application to SI initiatives).

The chapter by *Laura Mariani, Dario Cavenago* and *Elisabetta Marafioti* explores grassroots sustainable innovations as novel and sustainable solutions designed and developed by the actors of civil society in order to respond to local issues. By focusing on three case studies of food banks across Europe, their chapter assesses SI business models so as to identify drivers that can support and favour the diffusion of such initiatives, in order to reduce the problem of food surplus in European countries.

The chapter by *Rick Hölsgens* explores the importance of addressing both the innovator and the adopters when trying to grasp the dynamics of sustainable social innovation diffusion. The author concludes that by asking why, rather than how, sustainable social innovations diffuse, it becomes evident that the acceptance of sustainable social innovations cannot be taken for granted. Both innovators and adopters need to be motivated to actively diffuse social innovation and they need to have the capacity to do so.

*Guillermo Velasco, Monika Popper* and *Rafael Popper* take a closer look at lessons learned from the analysis of 1700+ “critical issues” emerging from the assessment of 200+ SI initiatives in Europe and the world. The critical issues were mapped against technological, economic, environmental, political, social, ethical and spatial perspectives, and their analysis allows the authors to draw 60 managerial messages. The key considerations and lessons for SI management are related to important, feasible and impactful actions, which selected innovators prioritised to solve SI critical issues and support the development and success of this kind of an initiative.<sup>2</sup>

Finally, *Tiina Pajula* and *Rafael Popper* reflect on the growing need to reduce fragmentation of SI community of practitioners and scholars through a hybrid

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<sup>2</sup>The readers should also note that given the nature and weight of the conceptual, methodological and managerial implications of CASI-F in the CASI project and this book, it was decided by the Editors that Chap.1 and Chap. 9 would collect and summarise important findings previously published by the authors in several reports for the European Commission (which are cited accordingly); however, the chapters still provide new perspectives and substantial amount of new insights and lessons.

- Popper, R., Velasco, G., and Popper, M. (2017). CASI-F: Common Framework for the Assessment and Management of Sustainable Innovation, CASI project report to the European Commission. Deliverable 6.2.
- Popper, R. and Velasco, G. (Eds.) (2017). Sustainable Innovation Policy Advice. CASI Project report. Deliverable 7.2, European Commission.
- Popper, R., Velasco, G. and Ravetz, J. (2016) *State-of-the-art of Sustainable Innovation: Climate action, environment, resource efficiency and raw materials*. CASI Project report to the European Commission. Deliverable 2.1.
- Popper, R., Velasco, G., Bleda, M., Amanatidou, E., Ravetz, J., Damianova, Z., Kozarev, V., Chonkova B., Tsin, S., Avarello, A., Martin, L. and Morris, D. (2016). “Sustainable Innovation Conceptual Framework”, CASI Project report to the European Commission. Deliverable 2.2.

framework for SI assessment and management that combines the qualitative and forward-looking approaches used in CASI-F with quantitative methods such as Life Cycle Sustainability Assessment (LCSA).

The time seems ripe to investigate the somehow ambiguous aspects of sustainable innovation. This book offers its readers a myriad of insights, practical examples, protocols and tools to explore the more indefinable characteristics of SI. The collection of chapters aims to shed light on a number of important modern-day issues related to *Governance and Management of Sustainable Innovation*, which may be of interest to researchers, practitioners and decision makers alike, who are alarmed about the sustainability of our future. As observed by Ian Miles in the *Foreword*, this book is “*an invitation to further development of the ideas, to further exploration and innovation from activists, researchers, and practitioners of all kinds. It recognises the need for numerous initiatives to be taken, on many scales, with many engaged constituents. And it avoids the trap of assuming that change can be smooth and linear, whereas in practice it is often bumpy and winding*”.

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# Contents

## Part I Conceptual Framework and Empirical Context

- 1 Sustainable Innovation Assessment and Management Framework: Principles, Methodology and Practice . . . . . 3**  
Rafael Popper, Monika Popper, and Guillermo Velasco
- 2 Sustainable Innovation: Definitions, Priorities and Emerging Issues . . . . . 41**  
Aleš Lipnik and Maja Cergol Lipnik
- 3 Types of Innovation for Sustainability: The Role of Social Innovations . . . . . 57**  
Rick Hölsgens and Jürgen Schultze

## Part II Participatory Governance of Sustainable Innovation

- 4 Exploring the Role of Stakeholder Engagement for the Development of Sustainable Innovation Strategies . . . . . 75**  
Mattia Martini, Elisabetta Marafioti, and Monica Carminati
- 5 Targeted Forward-Looking Citizen Engagement: The Case of Sustainable Innovation . . . . . 97**  
Petteri Repo, Kaisa Matschoss, Bjørn Bedsted, Zoya Damianova, and Ventseslav Kozarev
- 6 Stakeholder Engagement as a Tool to Support Sustainability-Oriented Innovation in the Public Sector . . . . . 121**  
Benedetta Trivellato, Monica Carminati, and Mattia Martini

**Part III Management of Sustainable Innovation**

**7 Fostering Sustainable Innovation: Insights from Three European Food Banks** . . . . . 139  
Laura Mariani, Dario Cavenago, and Elisabetta Marafioti

**8 Why Sustainable Social Innovations (Do Not) Diffuse? An Alternative View to Social Innovation Dynamics** . . . . . 161  
Rick Hölsgens

**9 An Inductive and Multidimensional Approach to Sustainable Innovation: Evidence from Multiple Case Studies** . . . . . 181  
Guillermo Velasco, Monika Popper, and Rafael Popper

**10 Towards a Hybrid Framework for Sustainable Innovation** . . . . . 199  
Tiina Pajula and Rafael Popper

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# List of Abbreviations and Acronyms

AMAT	Agency for Mobility, Environment and Land
ATM	Milanese Public Transports
BEPA	Bureau of European Policy Advisors
B2B	Business To Business
B2C	Business To Consumers
CASI	Public Participation in Developing a Common Framework for the Assessment and Management of Sustainable Innovation
CASI-F	Common Framework for the Assessment and Management of Sustainable Innovation
CE	Eco-Innovation and Circular Economy
CIMULACT	Citizen and Multi-Actor Consultation on Horizon 2020
CIVISTI	Citizen Visions on Science, Technology and Innovation
COTEC	Italian National Foundation for Technological Innovation
CSR	Corporate Social Responsibility
CTA	Constructive Technology Assessment
EC	European Commission
EE	Ecological Economics
EMT	Ecological Modernization Theory
EU	European Union
EFB	Estonian Food Bank
FAO	Food and Agriculture Organization of the United Nations
FBA	Fondazione Banco Alimentare
GDP	Gross Domestic Product
ICT	Information and Communication Technology
IE	Industrial Ecology
IPCC	Intergovernmental Panel on Climate Change
IPR	Intellectual Property Rights
IS	Innovation Studies
ISIC	International Standard Industrial Classification

ISO	Quality Management Standard
LCA	Life Cycle Assessment
LCSA	Life Cycle Sustainability Assessment
LDA	Latent Dirichlet Allocation
MLP	Multi-Level Perspective
MML	Mobilisation and Mutual Learning
NGO	Non-Governmental Organisation
NIS	National Innovation System
NPO	No Profit Organization
OECD	Organization for Economic Co-operation and Development
PEF	Product Environmental Footprint
PR	Public Relations
R&I	Research and Innovation
RSI	Responsible Sustainable Innovation
RTDI	Research, Technology Development and Innovation
SC5	Societal Challenge 5
SDGs	Sustainable Development Goals
SI	Sustainable Innovation
SI-Drive	Battery Technology to Drive Electric Vehicles of the Future
SIMG	Italian Society of General Medicine
SME	Small and Medium Enterprise
SNM	Strategic Niche Management
SOI	Sustainability-Oriented Innovation
STS	Science, Technology and Studies
TEEPSES	Technological, Economic, Environmental, Political, Social, Ethical and Spatial
TRANSIT	Transformative Social Innovation Theory
UN	United Nations
WT	Wiener Tafel
WWII	Second World War