

Preface

With this book, we have set ourselves an ambitious target to provide the readers with a simple graphical tool—the socio-technical map—that may help them understand how the environmental sustainability of human activities may be reached. In other terms, we have tried to make simple a very complex process. To reach this goal, we founded our work on the recently emerged research field of sustainability transitions (SusTrans). The starting point of the SusTran approach is that most of human needs are fulfilled by systems which have proved to be environmentally unsustainable, and it is precisely for this reason that these systems should be radically changed. In other words, system innovation is at the heart of SusTrans.

Systems that fulfill human needs feature two relevant characteristics which should be seriously taken into consideration when aiming at the ambitious goals of curbing greenhouse gas emissions and reducing all other environmental impacts of human activities. First characteristic: These systems are embedded in the very structure of our society. Behind each good and service we produce and consume every day, one can find several interconnected elements: individuals and organizations, values and ideologies, technologies and infrastructures, markets and industries, rules and norms, and so forth. Thus, the functioning of these systems simultaneously involves the cultural, institutional, technological, and economic dimensions of human life: any attempt at reductionism—for example, to the technological or economic dimension of such systems—is not correct. Second characteristic: These systems are continuously changing. Their dynamics is generated by a process of structured action: systems are changed by human agents, but their action is in turn conditioned by the very structure of systems. Moreover—and maybe more important here—the outcome of such a process is uncertain: no change is known *ex-ante*, but it emerges as the (sometimes unintended) result of human action. This is why any attempt to describe system innovation as the result of a choice between given alternatives is not correct. If we keep in mind these two characteristics, we realize that an effective approach to environmental sustainability must be: (1) systemic, that is, able to consider all dimensions of innovation, not

only technologies or markets, but also behavior, rules, discourses, policies, etc.; (2) dynamic, that is, able to understand how new systems emerge through the alignment of innovations as they are generated.

In order to meet these two requirements, the SusTran approach mostly refers to the socio-technical (ST) analysis of innovations. Here, any societal function is fulfilled by one or more ST-systems, and its evolution is strongly affected by the interaction between a stable and dominant ST system and other existing or emerging ST-systems. Each of these ST-systems is supported by a network of agents interested in its reproduction. Following ST theories and concepts, a SusTran can be represented as a ST transition to sustainability: a process of radical change where the current dominant position of an unsustainable ST system is destabilized and took over by a new—and environmentally sustainable—ST system. In such a representation, innovators play a key role: both those innovating to protect a dominant position and those innovating to take it over. Such a competition between alternative ST-systems—and their supporting networks of innovators—is strongly affected by policies. In particular, a ST system is holding a dominant position also because it was able to gain support from favorable policies that now protect the status quo. This is why a SusTran may not take place without new and specific policies that: (a) help emerging ST-systems to consolidate and (b) destabilize the dominant ST system. This in turn implies that the competition between alternative networks of innovators taking place along a SusTran is not only about technological leadership and market power; it also refers to the ability of influencing public debates, political agendas, and actual policies. In other terms, political innovators and political innovations are relevant features of any SusTran.

Summing up: SusTrans are complex processes. They feature systemic changes, structured action, innovation-driven dynamics and—last but not least—competition on multiple dimensions. As stated at the beginning of this Preface, the ambitious goal of this book is to provide the reader with a simple graphic tool—the socio-technical map (ST-map)—which can be used to represent a SusTran without renouncing to the understanding of its complexity. In particular, with this book any scholar or practitioner interested to the issue of sustainability will be able to understand how the current situation of any societal function may give place to different ST transition pathways. The dynamics of the relevant networks of innovators—and their technological, market, and political strategies—will be the key variables to assess the likelihood of the resulting alternative scenarios. The ST-map can also be used to understand which policies are deemed necessary to support those ST transition pathways—if any—that can be considered as SusTrans.

The book is divided as follows: In Chap. 1, the essential basic concepts that are needed to build a ST-map will be presented; a specific attention will be given to the definition of ST-systems and SusTrans and to the role played by network of innovators. In Chap. 2, we will explain in detail how to build a ST-map and how to use it to generate alternative ST transition pathways; in particular, we will see how to position in the ST-map all relevant networks of innovators and how to forecast their future dynamics. In Chaps. 3–6, the results of some case studies will be provided: the societal functions of feeding, mobility, and lighting were analyzed in

order to ascertain if the ST-map can be adapted to different situations. With the case of food, we verified that the ST-map is able to represent a transition featuring different (if not conflicting) visions of sustainability; with the cases of mobility, we found that both global and local dynamics can be considered starting from the same ST-map; in the case of lighting, the ST-map proved useful to generate new knowledge on the overall dynamics of dominant ST-systems and policies. On the whole, case studies also confirmed that the ST-map is a more appropriate and powerful analytic tool for prospective rather than retrospective studies.

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