The Who, What, How and Why of Governing Change. First Lessons and Ways Forward

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This is the preprint version of the conclusion chapter published as:

Borrás, Susana and Edler, Jakob (eds)(2014): The Governance of Socio-Technical Systems: Explaining Change. Cheltenham: Edward Elgar. ISBN: 978 1 78471 0187

Introduction

This book brings forward a focus on the governance of change in socio-technical and innovation systems. In the introductory chapter of this book we defined the **governance of change in ST&I systems** more concretely as *the way in which societal and state actors intentionally interact in order to transform ST&I systems, by regulating issues of societal concern, defining the processes and direction of how technological artefacts and innovations are produced, and shaping how these are introduced, absorbed, diffused and used within society and economy.* While our approach to the governance of change acknowledges the normative dimensions of 'governance', it emphasizes its analytical dimension for studying these complex societal and political processes. In order to do so, we have first proposed a simple typology of governance situations and then developed a conceptual framework based on three interrelated pillars: the opportunity structures and capable agents, governance instrumentation and democratic legitimacy. These three pillars constitute the theoretical foundations from which a set of specific questions are formulated in order to focus the study of system's change on the study of the underlying governance processes and dynamics. The starting point for this book was the observation that the literature has not provided a well-organized focus on the underlying processes and conditions for governance of change in socio-technical and innovation systems.

We organized the analytical questions posed in the opening of this book around these three pillars. When considering the role of and interaction between the opportunity structures and capable agents, our conceptual framework looks specifically at the role of agency. Hence, the overall issue here is to define *who and what* drives change. This leads to the analytical questions: Who are the primary agents of change? What is their capacity to induce/inhibit change? What capabilities do they have (resources and interpretative abilities)? What is the distribution of the agents' capabilities within the socio-technical and innovation system, and how does this affect the action of these agents?

Regarding the second pillar, instrumentation, the main issue we turn to is *how* change is influenced. From this, the following concrete analytical questions were identified at the onset of this book: What are the instruments used? By whom are they used? How are they implemented? How are the instruments shaped? How do public and private instruments interact? How and why do they 'work' or not work, and how do they interact with other instruments? What are the instrumental tensions, and how are they resolved (if at all)?

Last but not least, democratic legitimacy as the third analytical pillar looks at *to what degree* and *why change* is *accepted*. The concrete analytical questions here are: What are the actor arenas and the poly-centrality of governance, and what are the resulting tensions and challenges for legitimacy? What is the cultural embedding of governance instruments and how does it change over time? How socially accepted are the governance processes and outcomes, and why is this? How is contestation of processes and outcomes dealt with?

Using this framework, we finish this book with first conclusions drawing from the cases presented in this volume. We first characterize the nature of governance of change in socio-technical systems in the case studies in the previous chapters of this book. To do so, we apply our two-dimensional typology of modes of governance elaborated earlier in the opening chapter. This is followed by a more in-depth synthesis for each of the three pillars, reflecting on the theoretical implications drawn from the empirical analysis in the different chapters. Following from the overall findings of this book, we conclude with some thoughts on a future research agenda that works towards a theory of governance of change in socio-technical systems.

9.2 Governing change: What governance?

In a first step in our theoretical approach, we have outlined a typology of governance modes, differentiating the type of actors and the form of domination along two dimensions. Naturally, this is a simplification of the complexity of governance, but it nevertheless allows for a first characterization of different key features of the concrete empirical cases, as a basis for understanding governance of change more deeply.

Table 9.1: Typology of governance modes

	Driven by state actors	**Driven by societal actors**
Hierarchical, dominated	Command and control	Oligopoly
Heterarchical, non-dominated	State as primus inter pares	Self-regulation

The examples in this book show different types of governance at play, with different consequences for change. In Barberá-Tomás and Molas-Gallart's analysis of the governance of medical devices we see a case of predominant command and control through regulation. These authors show how regulation influences the direction and rate of change over time, the interplay of regulation, and technical change, which in their case leads to undesired outcomes. We see the shortcomings of governance situations that are dominated by command and control in cases where a technology has reached maturity, and regulation assumes (wrongly) that incremental innovation is safer for the patients. This points towards the contrasting meaning of regulation as trigger and inhibitor of change: While regulation can certainly lead to change and is often used to induce firms to innovate more radically (i.e. in the field of eco-innovation), it can also cement the lock in of socio-technical systems if it is defined to allow for too much incremental innovation in a specific search trajectory where technological solutions are exhausted. In other words, command and control governance can be strong in triggering change if it is deliberately designed to open for alternative technological trajectories (as is the case for example for some eco-innovation), but not when it is deliberately designed to force agents to stay in established technological trajectories. In order to avoid lock-in, regulatory systems dominated by command and control have to allow for opening up the debate to incumbent stakeholders on the supply and demand side, allowing to challenge and alter regulation in view of systems' transformation and technological change.

Two other chapters in this book represent the governance type of 'state primus inter pares', where transformation is driven primarily by state actors, but the governance process and its effectiveness are entirely dependent on the interplay between state and non-state actors. The governance of discontinuation in the empirical example presented by Stegmaier, Kuhlmann, and Visser shows that in order to change radically, old systems and practices must go, and that this discontinuation requires purposeful state actors and a conscious discontinuation governance. This does not work through command and control alone, but needs consensus building and interaction with societal actors. A very different case of state driven governance in heterarchical settings is the case of change in translational research in biomedicine as analysed by Vignola-Gagné et al. The authors show how the implementation of translational research (TR) programmes in biomedical RTD sites located in Austria and Germany, while driven by state actors and preferences, is strongly dependent on a range of stakeholders and their learning over time.

The three other cases in this book represent governance that is dominated by societal rather than state actors. Interestingly, all three examples are concerned, in one way or another, with market creation and standard setting. Daemmrich's analysis of the role of technical standards in the development of biodegradable plastics is an excellent example of *oligopolistic* societal governance. It shows the role of a limited number of strong societal players who by setting standards in fact perform anticipatory market building and thus shape the direction of change of the system.

Delemarle and Laredo have a similar approach when discussing arenas of societal and state actors who create a set of market infrastructures for emerging technology (nanotechnology). They show how the governance of infrastructure creation is dispersed across multiple arenas, preventing the dominance of one group of societal actors in what we can label as a multiple

oligopoly. Thus, their case could be situated half way between self-regulated and oligopolistic governance. Their micro analysis of the arenas and their interplay sheds light on the fact that societally dominated, polycentric governance mechanisms need certain preconditions to work, and only if we understand those preconditions, we can understand the opportunities and limits of social-actors' driven market creation.

Finally, Loconto and Barbier represent an example of self-regulation, with minimal involvement of traditional state regulatory actors in the definition and implementation of agro-food standards. Here, the authors highlight the preconditions and limits of those self-regulated mechanisms, ranging from appropriate framing of the issue, to the build-up of credibility and legitimacy as a crucial condition for compliance.

As we have seen, the chapters in the book represent the four fields in our governance matrix above. What lessons for our three pillars can now finally be drawn from those cases and types of governance in this first, exploratory discussion about the who, what, how and why of governing change in socio-technical and innovation systems?

9.2 Governance of change: Lessons for our pillars

9.2.1 Opportunity Structures and Capable agents

Our first pillar is concerned with the question about who and what drives change, focusing on actors and their governance capability and intentionality across the system. Across the case studies in this volume, the agents driving change have displayed a high level of organizational capability, mobilizing and combining other actors' knowledge, contributing strongly to framing the problem, and having the endurance needed for promoting system change. Those attributes are nothing extraordinary in the context, for example, of institutional entrepreneurs. However, a closer look across our chapters shows some dimensions of capabilities that seem more relevant for our question of system's change.

A first conclusion of the chapters in this volume is that capability of actors in the governance of change is based on their *ability to manage heterogeneity*. Arthur Daemmrich's chapter on the governance of change in the socio-technical system towards biodegradable plastics shows the mobilization of interdisciplinary and inter-organizational cooperation, moderated by capable agents towards the establishment of a new standard. However, in spite of this capable agent and of the opportunity structure offered by new technical solutions, change of the socio-technical system did not materialize because consumers did not respond to a sufficient degree. Thus, although BASF, standard bodies, and environmentalist groups were capable agents in the governance of change, the anticipated market reaction did not correspond to expectations and behaviours across the range of affected stakeholders.

A second example for the importance of managing heterogeneity is presented by Alison Loconto and Marc Barbier and their case of sustainable standards in the agro-food system. This case is about one central institutional actor, the inter-organizational ISEAL alliance. In many

ways, this analysis shows that this alliance is the most relevant capable actor in the international sphere when it comes to define the transnational standards for the certification of sustainable agro-food products. The pragmatic approach of this central actor has given way to a successful strategy fostering the growth of sustainable certified products world-wide. However, the success of the standards largely depends on the *successful framing of credibility* not only locally, but transnationally. This, in turn, is very much dependent on the ability of the capable agents to *mobilize and link different kinds of knowledge* (expert, experiential) in line with its own core values and image as a *credible promoter*.

In contrast to the prominence of one central association of actors as change promoter, Delemarle and Laredo demonstrate that system change can be a product of the *interplay of* a *multiplicity of capable actors*. They conceptualize change as the creation of a market infrastructure defined as a set of rules (what actors are allowed to do), of norms (what they ought to do) and of values (what they want to do). Using the example of nanotechnology, they stress that a whole range of very different actors are engaged across a number of related arenas. They point towards the *capabilities of arenas* as ensembles of actors who are tasked with the production of specific elements of market infrastructure. Thus, creating market infrastructure through a variety of different instruments is not only about the capabilities and drive of individual actors to initiate and contribute to market infrastructure creation, it is about the *organizational capabilities within* and *of arenas* to mobilise and moderate discourses and deliver on outputs that contribute to the market infrastructure. Change in socio-technical systems, particularly when it comes to the creation of markets, can only be understood if we broaden our concept of capabilities and also think about *capabilities of collectives* to prepare for and enable that change. This is especially true in the absence of meaningful state actor influence or command and control governance, in particular in situations where the opportunity structures are not well defined yet, typically in emerging and enabling technologies with many possibilities of being used in a broad range of sectors/products (like the case of nanotech).

In the case of discontinuation, conceptualized and empirically illustrated by the chapter of Stegmaier et al., we learn that even though there was an overwhelming societal consensus across Europe and some initial national initiatives, for a long time this consensus was not strong enough to initiate system change. It took the lead of the EU Commission as the supranational body to regulate the discontinuation in a meaningful way. The reason for this is probably that the EU Commission *combined* its *regulatory power* with a *range of discursive instruments*, thus combining powering and sense-making. The Commission designed a multi-step process with *different degrees of openness and inclusion*. This case is an illustration of the importance of agents' capabilities to design a process, particularly in complex, contested situations of change.

A different kind of institutional entrepreneurship is analysed in the case of change in biomedical research towards translational research. Here, *individual institutional entrepreneurs*, such as scientists convinced of the inner logic of translational research (TR), in conjunction with international advocacy coalitions took the main initiative. The resources they could draw on were partly *organizational* (e.g. scientists in important management positions)

and partly *intellectual credibility* and the ability to create win-win situations to underpin the visions of change.

9.3.2 Instruments for the Governance of Change

Our second pillar is concerned with how change is influenced, which instruments are used by whom, how instruments interact, to what extent they work and why, and how potential tensions between instruments are resolved.

Three chapters in this book have impressively shown the importance – and limits – of standardization processes and standards as instrument to govern change through enabling market creation. Daemmrich's case emphasizes that standards are not just a process of creating *uniformity and predictability* related to new products, but in doing so have a much broader role to play. As a tool for *anticipatory market creation* they *coordinate technology* and *social institutions* within heterogeneous actor landscapes. In his case of biodegradable plastics, voluntary standards were a crucial instrument for change because they enabled the firms to differentiate a product category (biodegradable plastics) relative to other synthetics, they established a market based on further criteria beyond price alone, and they informed about the new market. Further, the development of the standards was organized in an interactive manner to include a broader perspective from the outset, such as involving user groups. However, these functionalities of standards have *limits*. The standard on the biodegradable products worked *only in conjunction with other regulation* which internalized externalities of the product that was supposed to be replaced and which shifted the economic argument in favour of innovation. Further, once the standards were set, they were initially less effective than expected, as consumer's behaviour did not change in line with the underlying expectations embedded in the standard itself. The *involvement of user groups* in the development of the instrument was *not sufficient* for the standard to be widely effective. However, as a tool for change, standards have subsequently worked as they *allowed flexibility* in other product specifications to accommodate user's preferences without violating the spirit of the standard itself.

Barberá-Tomás and Molas-Gallart bring forward a very strong case regarding regulation as an instrument for the governance of change in socio-technical systems that induced a technological failure. Their study on the hip prosthesis defect case shows how regulation of medical devices can shape particular search trends that foster incremental rather than radical innovation. The assumption implicit in this command and control regime in the health sector, that incremental technical change is safer than radical technical change, proved to be wrong, with unintended severe consequences for patients' safety. The *burdensome regulatory framework* imposed on radical innovation discouraged radical change vis-a-vis incremental change. This case shows that the outcomes of governing change in a socio-technical system are not only dependent on socio-political factors like assumptions underlying the regulations or social legitimacy, but also on the *technological features* of the products subject to regulation.

Alison Loconto and Marc Barbier shed further light on standards as governance instruments of change in their study of the development of sustainability standards in the agro-food system. Here, the process of standardization, largely driven by non-state actors, is first and foremost a process *of knowledge framing, capability building and norm setting.* The case of the meta-standards of the ISEAL alliance demonstrates the different but complementary processes to build up necessary capacities and a common stock of knowledge in the standardization process, e.g. through negotiations to define the auditor competences, the auditing sampling and the technical credibility of the standards. Further, sustainable standards have implications for socially responsible investing and organizational buying and accounting, and hence they embody specific normative and moral dimensions. Second, standardization processes not only re-frame knowledge and norms, but do so *through changing the relationships* between market, state and civil society. In the particular case, this was driven by the multi-stakeholder initiatives and transnational alliances.

An even broader and more holistic view on instrumentation is taken by Delemarle and Laredo in their analysis of market creation as vehicle of system change. The authors conceptualize change in socio-technical systems that is driven by emerging technologies as the successful creation of market infrastructures. The authors demonstrate convincingly that there are many different kinds of instruments that contribute to the overall emerging market infrastructure (standards, guidelines, policy reports, knowledge databases/journals, code of conduct and regulatory frameworks). Those instruments are constructed simultaneously in different public-private arenas. The authors discuss the conditions under which the various instruments become effective. Most importantly, those conditions have to do with the structural and procedural conditions of the arenas that produce the instrument and with the conditions for interconnections between the arenas. The main lesson here is that the question of instruments, thus, cannot be tackled without understanding the arena of their origin (and the legitimacy of that arena, see below), and change in socio-technical system is driven by sets of instruments rather than individual instruments.

Traditionally, instrumentation in socio-technical systems is associated with the idea of supporting positive change, i.e. supporting activities and capabilities that positively generate something new in the direction of desired change. Stegmaier et al. show that when we are faced with a discontinuation problem, we need a problem framing of what the underlying problem in the previously stabilized system is. In addition, we need to find *instrumentation to adjust and discontinue existing framework conditions* and *governance practices* that had stabilized the socio-technical system that is to be discontinued. This is essential if we want to understand the governance of change, because creating something new might often require proactive initiatives to discontinue the old. Stegmaier et al. show that command and control instruments alone are not enough; to discontinue also means to alter routines and practices of suppliers and users of technologies.

In their analysis of change in biomedical research towards translational research, Vignola-Gagné et al. take a functional perspective and discuss how *different instruments*, with quite different functions (research grant funding, infrastructure funding, professionalization of education, organization building), *together pulled in the same direction* in order to change research orientations. Interestingly, not all of those instruments were new, but rather,

purposeful actors (see above) took advantage of existing instruments and re-defined their rationality. The combination of various (new and old) instruments created incentives and framework conditions conducive to the new policy paradigm and in doing so allowed a re-alignment of actors in novel ways.

9.3.3 Legitimacy

Our final pillar is focusing on the question of the extent and nature of social acceptance of governance of change, asking about the challenges for legitimacy arising from poly-centrality of governance, the importance of cultural embedding of governance, the conditions for output and input legitimacy, and the way conflicts about legitimacy of governance are dealt with.

A main lesson is that governance of change relies strongly on *input legitimacy*. This is due to the high level of uncertainty and the long term nature of effects (and thus the output dimension) of change in the system. Uncertainty increases the need to search for ideas and knowledge that can support and direct governance of change. It also works towards a broader inclusion of actors to mobilize stakeholder views and identify opportunities and challenges broadly. The long term nature of effects in many instances of change of systems seems to reduce the relative importance of output legitimacy for the actual process of governing change. The examples in this book indicate that *the social legitimacy of governance is related to the ideational and organizational sources of change, to the credibility of the agents of change and of the technical solutions proposed; and to the processes related to governing change.* For example, in Daemmrich's discussion of biodegradable plastics, legitimacy stems from the *discourse arrangement* in the standard setting arrangement as well as the *credibility* of the standard setting body and complementary institutions providing scientific underpinning. Thus, the final effectiveness of the standard can only be understood in conjunction with the credibility of its production and the capabilities and strategies of the main agent of change that pushed for the standard. The negotiation over technical aspects, e.g. in standardization processes, is at the same time a process of re-framing and joint sense-making. The 'what' and 'how' in those technical discussions is intimately interlinked to the 'why' and 'what for', and if those questions can be aligned, new standards are rendered into powerful tools of change in the socio-technical system.

When it comes to legitimacy in terms of the ideational and cognitive sources, national practice often draws on *international discourse*. International cognitive and normative ideas are taken up and transferred in national contexts. In their discussion of attempts to re-orient biomedical research and innovation activity towards more user involvement (translational research), Vignola-Gagné et al. show the two ways in which new international legitimacy claims affect local change. First, *local communities* are *part of the broad international epistemic* and policy discourse, embedded in the re-definition of cognitive and normative claims. Second, legitimacy claims are *pro-actively constructed and instrumentally used* by transnational and localized advocacy coalitions in favour of change. However, the authors demonstrate that despite the programmatic and normative legitimacy of the claim for translational research that emerged in

the Austrian cases, there was no broad re-orientation of practices. This was partly due to the fact that the *operational requirements*, such as provisions for the inclusion of patients into the research programme design, were *not in place*, and partly to the fact that the legitimacy claim was instrumentally used by local entrepreneurs to capture existing instruments, rather than to live up to the normative core of translational research. More deeply, though, the international epistemic and policy discourse does not seem to have led to a broad and deep enough re-orientation of actor's behaviour.

The critical issue of input legitimacy is further highlighted by Loconto and Barbier's case of ISEAL alliance standard setting for sustainable agro-food products. The authors show the complexity of legitimacy issues in the governance of change in socio-technical systems. The *technical credibility* of the standard is a key aspect for its legitimacy at different levels (producer, consumer, etc.), but the framing of that technical credibility into specific knowledge is not easy. The case shows that the pragmatic approach of ISEAL is to put forward a vision of conformity assessment that is based on the idea of appropriateness or 'fit for purpose' rather than an ideal type of credible guarantee. This *pragmatic* and *flexible* approach is strategic, because it enables scaling up activities that would ultimately allow to gain terrain over competing (non-certified sustainable) agro-food technical system. But it might turn out to be problematic in legitimacy terms as ISEAL members are raising the question of who accredits the accreditors. This again corresponds to questions about input-legitimacy (who makes the decisions and how) rather than to output-legitimacy (how effective are the collective actions) which is based on the technical knowledge embedded in the sustainable standard and in the certification of individual products.

In their discussion of market infrastructure development through multiple arenas and governance arrangements, Delemarle and Laredo demonstrate the *multiplicity of legitimacy* sources in one technological area. As different arenas have different contributions to the development of market infrastructure for new technologies, each arena has slightly different legitimacy foundations. All of those claims are mainly about the procedural aspects of input legitimacy in the governance of change – such as self-organized participatory processes and openness of expert knowledge and data. In addition, legitimacy is based on the credibility of international organizations. In this case this refers to the regulatory framework of the EU (hard law regulations) and to the OECD's mandate to promote policies globally. However, the way the legitimacy claims pan out depends in addition on the credibility and operational effectiveness with which agents of change in the respective arenas can deliver.

The legitimacy of governing change towards the *discontinuation* of socio-technical systems has its *specific challenges*. As Stegmaier et al. show, discontinuation is normally a very long term process, during which various vested interests are affected, and long established routines and practices as well as normative and cognitive beliefs have to be changed. Thus, not only is a strong and convincing normative and cognitive argument to be made for a new problem perception and a credible solution. Those initial legitimacy claims also need to be put forward by credible advocacy coalitions and need to be upheld both in terms of the credibility of the underlying rationale and knowledge, and in terms of the governance process and practices themselves.

Finally, Barberá-Tomás and Molas-Gallart remind us about the potential *loss of legitimacy* in socio-technical systems and their key institutions if they fail to deliver appropriate solutions. This is what we call output legitimacy. In their case, a strong regulatory regime prevented radical technological change because it was based on unsuitable assumptions about risk. The result was a failure to deliver appropriate solutions, in this case patients' safety. This example shows how the governance of change, biased towards incremental rather than radical change, produced outputs that were not legitimate. Finally, and perhaps most important, it reminds us that governance of change in socio-technical systems is after all about improving social well-being through better solutions.

9.4 Achievements – and a Future Research Agenda

This book started form the observation that despite the vast literature about change in socio-economic systems, the way change in socio-technical systems is actually governed is still poorly understood. The framework that we have developed in this book is a first step towards a theory of governance of change which has governance at its core, focusing on the three main elements of governance and looking at them together: purposeful actors and the opportunity structures they create or take advantage of, the instruments that are used in governing change, and the nature and conditions for the legitimacy of change and its governance.

As the analysis of each case and the cross case analysis above have shown, to look at governance of change through our lens does allow us to better understand the nature and hurdles associated to the governance of change, the role actors and structures play, the instruments for governing change, and the underlying reasons and processes for societal acceptance. For each pillar, this analysis has allowed a first abstraction, a first lesson towards a more holistic theory building. We have seen that system's change is not mainly determined by socio-cultural context conditions or by market forces, but by a combination of the two, greatly influenced by purposeful actors, the instruments deployed, and the legitimacy claims that are made and sustained. At the same time, the cases have shown that it is not agency or institutions, but agency and their capacity within (changing) institutional frameworks that drive or hinder change.

As we have seen across the cases, the dynamics related to the governance of change have a lot to do with the way actors interpret the system and the value it generates, and how they assess the value of system's change, triggered by technological change or by change in societal preferences. This is not only a highly reflective process, but a highly political process as well.

A next step towards a theory of governance of change in socio-technical systems would involve a more systematic look at the conditions and processes within the three pillars, and a more systematic development of how the three pillars interact, and how this interaction in turn is influenced by the prevailing governance type and socio-technical conditions in the system. This next step would allow us to make predictions about what modes of governance are associated to different forms of system change (or lack of change).

Our journey towards a theory would allow us to analyse the governance of change in socio-technical and innovation systems in a holistic way. The cross case analysis performed in this concluding chapter induces one basic idea towards a comprehensive theory, which is the relation between basic properties of the system and the change under question (the level of uncertainty, the degree of transformation and the heterogeneity of the actor landscape in a (changing) socio-technical system) on the one hand, and the characteristics and dynamics within and the interplay of our three pillars in the governance of change, on the other hand. This is only possible now that we have conceptualized and understood the pillars themselves. The ultimate destination of our journey would be a middle range theory about the governance of change in socio-technical and innovation systems. To get closer to that destination will be the core of a new and collective research agenda ahead of us. You are welcome to join us in that journey.