



Long-Term Governance for Social–Ecological Change

Edited by Bernd Siebenhüner,
Marlen Arnold, Klaus Eisenack
and Klaus Jacob

Routledge Research in Environmental Politics



Long-Term Governance for Social–Ecological Change

The book discusses how to tackle long-term social and ecological problems by using different environmental governance approaches to creating sustainable development. It explores opportunities and requirements for the governance of long-term problems, and examines how to achieve a lasting transformation.

Combining the perspectives on the different governance approaches and featuring cases studies on national, regional and global issues, *Long-Term Governance for Social–Ecological Change* will be of interest to policy makers, students and scholars of global environmental governance, development, sustainability, politics, economics, law and sociology.

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Preface

Social–ecological change affects almost all areas of human life. Well-being, prosperity, health, food safety, social cohesion, energy supply, provision of drinking water, housing and alike are all characterised by the interaction of social and ecological dimensions and their services for humankind. They are closely connected with severe ecological problems such as climate change, loss of biodiversity, degrading ecosystem services, etc. What is more, all of these problems are long-term developments that require decades rather than months or years to be abated. Infrastructures as well as basic mechanisms of the earth system can only be altered over long time periods. This applies particularly to the energy supply system, food and crop systems, water supplies, patterns of mobility and others. The long-term dimension is a common characteristic of most of these problems of social–ecological change that pose particular challenges to decision-making processes in the political and economic realm. In particular, the short-term focus of democratic decision-making within four to five-year election periods and even shorter budget cycles and the focus on short-term profits in most businesses often hinder the effective combat and prevention of long-term problems of social–ecological change. This gap between the long-term dimension of the pressing problems and the short-termism of our current governance processes implies also a challenge for social science research that motivated us to work on this book.

This book emerged as a result of the Berlin Conference on the Human Dimensions of Global Environmental Change addressing the topic of ‘Long-Term Policies: Governing Social–Ecological Change’. It was also the international conference of the Social–Ecological Research Programme of the German Federal Ministry of Education and Research (BMBF). Since 1999, this programme has addressed the challenges of social–ecological change in numerous research endeavours. Following an innovative inter- and transdisciplinary approach, this research has produced significant contributions to solve problems of long-term social–ecological change.

We would therefore like to thank the Federal Ministry of Education and Research (BMBF) as well as the conference hosts, namely the Oldenburg Centre for Sustainability Economics and Management (CENTOS) at Oldenburg University and the Environmental Policy Research Centre (FFU), Freie

Universität Berlin. We were particularly pleased about the endorsements of the Human Dimensions Programme on Global Environmental Change Programme (IHDP), the IHDP Earth System Governance Scientific Planning Committee and the German Association for Ecological Economic Research (VÖW)

This book came together as a selection of thematically best suited contributions to the conference. It was newly structured as we tried to develop some of the ideas and concepts further that were discussed at the conference. As a peer-reviewed product, it has benefited a lot from the comments by two reviewers. The editors and chapter authors express their gratitude for their efforts and helpful comments. We would also like to thank all contributors to this volume. In addition, we are most grateful to Nadja Carius, Lucienne Damm, Cecilia Homilius, Birgit Schelenz, Cornelia Wolter, Eike Zaumseil, and Ruben Zondervan for their organisational support and the formatting.

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1 Long-term governance for social–ecological change

Setting the scene

*Bernd Siebenhüner, Marlen Arnold,
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Introduction

Long-term problems such as climate change or the over-exploitation of natural resources are characterized by the fact that the costs and benefits of addressing the problems are split up between different generations. Current and future climate change is caused by previous economic activities. Measures to mitigate CO₂ emissions will not have an immediate impact, but rather will only be effective in the long term. However, the costs of mitigation will be borne by the current generation. The loss of biodiversity, the overexploitation of ground water or land is subject to similar difficulties. The current institutional framework – largely based on principles of liberalism and pluralism – is not well equipped to overcome such difficulties; future generations are weakly represented – if at all – in decisions on the use of natural and economic resources. Hence, a central challenge to effective long-term policies is the development and establishment of conditions for appropriate political frameworks and institutions for long-term and sustainable action.

The basic relationship between humankind and nature within social–ecologic systems is marked by many such problems of intergenerational justice. The types of resources we extract and use, the infrastructure, the industrial structure, and the way cities are built and connected have a tremendous impact on the environment today, but policies to diminish these impacts will only affect future generations. Gains from our current investments will only be available for our children.

Similar incentive structures are visible in other cases as well: for politicians, costly policies with benefits beyond their electoral cycle are seen as problematic. Spending programs with goals and benefits beyond a budget cycle are equally critical. Companies are challenged with long-term problems when future profits are discounted or short-term profits for shareholders have to be earned that diminish the company's ability to provide additional financial capital for long-term profitable investments. These problems all suffer the same faulty logic: every generation has the primary incentive to lower their own costs and use existing resources to their own benefit.

Despite the governance apparatus that has evolved in the past two decades in the aftermath of the Rio Summit in 1992, most observers, both from a scientific

perspective as well as policy practitioners, agree that no sufficient and effective responses exist to bring long-term problems into the core of the institutional framework (e.g. Sprinz 2009; Lafferty 2004; Jordan and Lenschow 2008). So far, long-term issues with few exceptions are not on an equal footing with other goals and principles of modern statehood. For example, sustainability issues are not as equally considered in constitutions as other goals of statehood or individual rights. Another case in point relates to government budgets – the negotiations about budgets are dominated by contemporary actors and their interests rather than future generations.

Consequently, this book draws on the debates on ecological research, which was extended conceptually in the direction of coupled socio-ecological systems and included infrastructures and governance mechanisms to master social and ecological challenges (e.g. Fischer-Kowalski and Haberl 2007; Ostrom 2009). A couple of authors have proposed governance mechanisms to deal with long-term change. For example, Voß *et al.* (2009) propose the concept of reflexive governance for sustainable development. This governance concept allows experimentation regarding various policy instruments and mechanisms focusing on steering long-term problems. Further, Voß *et al.* (2009) argue for effective policy integration regarding sustainable development and long-term environmental governance issues. The discussion of earth system governance looks into the long-term governance problems of interconnected ecosystems and environmental damages which are not limited to national borders. It gave rise to the debate about effective international (or global) environmental policy structures, mechanisms and instruments. Biermann *et al.* (2009) prominently argued for the institutionalization of global environmental governance. On the basis of a long-term study of a period of about 30 years, The Social Learning Group (2001) analysed the dynamics of environmental innovation policies and institutional learning in a long-term perspective. Other insights on integrated governance approaches to long-term sustainability can be drawn from research on transition management (Kemp *et al.* 2011, 2007; Geels and Schot 2007). They introduce transition management as a multilevel model of long-term governance shaping processes of co-evolution by using visions, transition experiments and cycles of learning and adaptation. In doing so, transition management is intended to help societies to transform themselves in a gradual, reflexive way through guided processes of variation and selection (Kemp *et al.* 2007). The concept of a far reaching transformation is also pursued by the German Advisory Council on Global Change (WBGU). To meet in particular the long-term challenges of climate change, they call for a new social contract allowing for a societal transformation similar to the industrial revolution (WBGU 2011). Following these lines of analysis, this book starts out more systematically from the nature and the specific governance challenges of long-term problems of sustainability.

What becomes clear from this stream of literature is the wide agreement on the need for transforming socio-ecological systems towards a pathway of sustainable development. Further, there is agreement, that institutions are core in achieving such transformation. However, the views on how this actually works and what

kind of institutions would be suitable and required, vary considerably and depend on the underlying understanding and assumptions on governance and in particular how governments can become effective.

Against this background, the chapters of this book ask and seek to answer the question of what distinguishes long-term problems from other policy problems, what governance responses are available and used, and how could economic incentives, participation, as well as knowledge and learning help to address them. Consequently, this book represents a collection of inter- and trans-disciplinary work drawing on conceptual and empirical studies that study long-term sustainability problems and policies and resulting governance challenges from different scientific and methodological perspectives. It reflects an intellectual bridge between studies of coupled social–ecological systems (Young, Berkhout *et al.* 2006), social–ecological research (Becker, Jahn *et al.* 1997), evolutionary economics (Gowdy 1994; Dopfer 2001; Nill 2009) and institutionalism (Young *et al.* 2008, Biermann *et al.* 2009). Therefore, contributions to this volume present insights from transition research, integrated assessment, earth system governance, and sustainability science on how to analyse, transform, adapt, measure and how to solve long-term problems in an ecological and societal context. They apply an inter-disciplinary research toolbox and create an innovative approach to analysing long-term problems. It thus aims to assemble the actual scientific debate and relevant results of social-science research on long-term policies and enrich the scientific dialogue on long-term policies.

Defining long-term policies and problems

Voß *et al.* (2009: 276) characterise long-term policies as a response to social challenges by “[...] policy strategies that seek to change radically key societal structures. [...] The realization of long-term policy goals extends well beyond electoral cycles and management terms, even beyond a generation of civil servants.” This is close to merely defining long-term policies as long-lasting processes, policy targets for the far future, or long-living institutions, by whatever reasons there might be in place. It leaves open the question of why there are (or should be) long-term policies. If we subscribe to the existence of objective problems, we might be interested in the features of such problems that make long-term policies adequate responses.

This is considered by Sprinz (2009), who defines long-term policies indirectly as responses to long-term policy challenges, that “[...] last at least one human generation, exhibit deep uncertainty exacerbated by the depth of time, and engender public good aspects both at the stage of problem generation as well as at the response stage”. The need for long-term policies tends to be motivated by problems or trends that are slow and require substantial time to unfold completely. It is one underlying distinction that there are public issues that can be resolved quite quickly, while others need interventions over longer time frames.

What matters is not a definition of long-term policies by a precise time scale (years, decades, centuries), but by the properties that distinguish long-term policies from other policies pragmatically. Analysing the term “long-term problem” suggests the following properties:

- 1 problems which need a long time to unfold, e.g. due to long time lags between cause and effect, or due to slow or unnoticed change (creeping problems);
- 2 problems that involve issues of intergenerational equity and trade-offs, or where solutions involve issues of intergenerational equity and trade-offs. This type is clearly more general than just considering public-good problems. Even if we were living in an idealized world without intra- and inter-temporal market failures, issues of, e.g. intergenerational wealth distribution might be very pressing;
- 3 problems that cannot be resolved quickly, e.g. due to the dimension or complexity of the problem, or due to long time lags between implementation and effect.

Based on these considerations, long-term policies can be defined as institutions where current policy actions have effects in the (far) future, or that respond to problems resulting from current actions that have effects in the (far) future. These effects can take the form of bio-physical system changes, new or modified institutions becoming established, or of economic costs and benefits.

This suggests a short sketch of reasons that may render long-term policies desirable or necessary. If a problem in the far future can be anticipated, e.g. a large asteroid colliding with the Earth in 100 years, and there is much to do to solve that problem, e.g. evacuating an entire continent, this would be a case for starting a policy quite early and to design it in a way that makes it sustainable over that long period. However, if the problems lie far ahead, but solutions are simple to implement, there is no need to act immediately. The situation becomes more complicated when we consider uncertainty about the future – an unavoidable condition in most environmental problems. If, for instance, scientists foresee a problem in 50 years, e.g. strong changes in precipitation patterns due to climate change, but cannot predict anything about its properties, e.g. they cannot say where precipitation increases, and where it decreases, would this justify a long-term policy? It might be valuable to wait until uncertainties decrease, and act then. However, it might also be the case that there are means available that increase flexibility to be prepared for any change, in whatever direction that change might go. If this flexibility requires a long-term preparation, it would provide another case for long-term policy. These examples illustrate that the need for long-term policies depend on structural features of the perceived problems and the available repertoire of solutions. Depending on these, the need arises either for anticipatory long-term action or a reactive approach at a later stage after the problem has occurred or is more immediate.

Thus the central challenge of long-term policies lies in the connection between the properties of the specific long-term problem and the potential approaches for

an effective solution. In this book, we will analyse four major venues for such long-term policies. This addresses first the formation of adequate regulation and formal institutions, e.g. to remind current political decision makers to include the interests of future generations into their present policies. These formal institutions build on legal instruments to address the challenge of long-term policies. By contrast and second, economic incentives can help to overcome some of the disincentives to care for future generations. The question is how to design these incentives and under which conditions such solutions would function. Third, there is a need to integrate relevant actors and stakeholders into the decision-making processes by means of participatory processes. Through this inclusion, a broader set of interests can be included into the decision-making considerations. Fourth, actors need sufficient knowledge and a capacity to learn and act accordingly. Thereby, they will be enabled to respond to long-term problems or be put in the position to prepare for future problems. Following this structure, the book is organized into four sections studying (i) governance and institutions, (ii) economics and tools, (iii) participation and (iv) knowledge and learning.

Part I: Institutions and governance mechanisms

Long-term problems are matters of distribution of income and living conditions between different generations: The generation that invests is not the same as the one that harvests the gains from this investment. Phrased negatively, the generation that causes damages to ecosystems and depletes natural resources is a different one than the one suffering from the consequences. The abstinence in exploiting resources to keep them for future generations is the other side of the coin, and of similar difficulty. In most countries, the current institutions have been set up to address distributional conflicts between different groups of society or between different regions. The very basic principles of statehood, the modern welfare state, democracy, civil rights or the rule of law are meant not only to protect individuals against arbitrary acts of the majority or the powerful. They have also been developed to balance decisions, to enforce compromises between different groups of society and their interests. In democratic political systems, legitimacy is based on the principle of majority within the jurisdiction and the lawfulness on the basis of constitutional principles.

How is sustainability in the sense of the long-term preservation of natural, economic and social capital integrated into this institutional landscape? The core of sustainability is to fulfil the needs of the present generation without limiting the options of future generations (WCED 1987). Modern western statehood appears to be well developed to meet the needs of the present generation, but at the expense of other regions of the world and on future generations. Future generations are hardly represented in the present institutions, they have no veto power, and they are hardly protected by judicial review. There are almost no interest groups or political parties which form their basis by representing the future at the expense of the present. In distributional conflicts, the present generation is by far better represented than the future ones.

While this diagnosis is widely accepted among academics as well as policy makers in the field of sustainability, there are some exemptions in which states either provide the investments necessary for the long term (e.g. for infrastructures or education) or they provide the regulatory framework for private actors with a focus on long-term problems (e.g. regulations on the use of resources or land use planning). It is obviously the state that is particularly challenged to solve these kinds of problems while individuals or companies in most cases do not have the necessary resources and incentives to contribute or to preserve resources. It is thus worth studying these existing examples and exploring how governance approaches and their institutional framework can be applied to other long-term problems of environmental degradation or resource extraction.

Still, during the past 20 years, many efforts have been undertaken to overcome this situation and to integrate the long-term perspective of sustainability into the institutional framework of governments. The Agenda 21 as agreed upon at the 1992 Rio Summit is the most important cornerstone in this respect. Several discourses and related policy processes have spun off from this document. First, there is a management approach to strengthen and to integrate the concerns of sustainability into governmental decisions. Sustainable development is being implemented by means of determining goals, action plans for their achievements and indicators to measure success or failure. Evaluations and progress reports are meant to correct or to reinforce actions taken in safeguarding sustainability. Decision making in government, civil society and enterprises can thus be rationalized e.g. by procedures for evidence-based decision making. Second, participatory processes become increasingly accepted as part of long-term policy making representing more societal stakes than in conventional policy making contexts (see below). Third, an organizational approach can be observed that is, however, much less applied than in other policy domains, where institutions have been established to represent actors and their interests in decision making concerning sustainability. For example, only few countries have established ministries for sustainable development. There are few civil society organizations under the flag of sustainability. Sustainability is considered to be a subject matter that needs integration rather than specialization and therefore, it has to be addressed and integrated in the existing landscape of actors and organizations.

Rather than aiming at super-institutions such as a veto-right for future generations, it could be more realistic and appropriate to develop institutions that are able to learn, and to adapt to changing demands and conditions. Thus, more incremental approaches seem more likely to be implemented in today's political systems. However, adaptiveness and learning to encounter long-term challenges of societies need direction (Biermann *et al.* 2009). Therefore, a discourse on the values of common goods, transparency in decision making, equal opportunities to participate, a stronger call for evidence-based decision making would unfold stronger impacts and might increase openness to change.

The literature on adapting institutions to the long-term challenges demonstrates that there are no simple and straightforward governance solutions (Newig *et al.*

2008; Jänicke and Jörgens 2000). Despite many overlaps and complementarities, there are quite different approaches on how to prepare institutions for the future: By means of rendering decision making more rational? By means of knowledge and learning or participation? By means of strengthening actors and interests representing the future? By integrating sustainability into the core set of institutions? Or by extending adaptiveness and learning in general?

The chapters in Part I address these questions. They highlight that successful long-term policies need governance processes and mechanisms on all institutional decision-making levels – from the international to the local level. It is not yet clear which governance approaches will be more successful, but their applicability depends on the specific properties of the long-term problems they are intended to solve. Adaptive and reflexive governance approaches are at the centre of the chapters in this section as well as decentralized approaches. Furthermore, the contributions to this section deal with different institutions. They evaluate the possibilities and limitations of systems to react to long-term problems. This includes an analysis and discussion of factors for successful long-term governance approaches. These chapters focus mainly on normative problems, such as the limited legitimacy of institutions which are withdrawn from democratic processes and mechanisms such as the German Bundesbank. They find that the identification of and public discourse about long-term environmental problems will increase pressures within society and its relevant actors to address these issues. Studies on the diffusion of innovative policy instruments and institutions such as national sustainability strategies or impact assessments show that innovative mechanisms have the capacity to influence national decisions and politics. It also becomes clear that innovation does not only mean new policy instruments and institutions but that one also has to acknowledge the importance of technological innovations for effective environmental policy.

The chapter by Michael Pregernig and Michael Böcher focuses on the role of scientific knowledge in European environmental governance. In their contribution, they study the role of scientific experts in environmental decision-making contexts in 16 European cases of forest governance. Viewed in the light of three conceptual approaches, they conclude that neither a pure instrumental understanding of scientific expertise is sufficient to describe the science-policy interface nor a more strategic conceptualization of the role of scientists in political decision making. It is rather more a co-production of knowledge which can be found in most cases.

Martin Jänicke and Klaus Jacob analyse possible economic and social impacts of a comprehensive industrial transformation as well as the challenges for the steering capacities of societies. They compare the anticipated transformation to a low carbon, resource-efficient economy with the previous industrial revolutions. Similar to previous transitions, a shift in the energy basis of economies is in the core of the development. The first industrial revolution was not possible without the technologies, the societal and the organizational innovations which enabled the exploitation of coal as the energy basis for the emerging industries. The

second industrial revolution which paved the way for mass consumption was based on the use of oil. A third industrial revolution based on renewable energies is on the horizon. As in previous transformations, the change will not be limited to a replacement of energy, but it will also affect many other economic, societal and governmental aspects. The requirements for governance in these societies are enormous, but there are indications that societies are better prepared to meet these challenges and to overcome possible social disruptions than in previous transformations. There is, however, a competition emerging between the large economic regions in Europe, North America and Asia. The newly emerging economies play a crucial role in setting the pace for the transformation. The authors expect those regions to be successful that have the capacities to innovate, the resources to introduce new technologies in the market, opportunities to compensate disadvantaged regions and sectors, as well as an ambitious framework for environmental policies.

A large number of countries have introduced rules and principles in their constitutional laws to protect the environment. Similarly, international law provides such directions for the governance of socio-ecological change. But what does this mean in practice for governance? In his analysis of the constitutional provisions protecting the environment, Anél du Plessis identifies seven different activities to comply with the duties generated by constitutional environmental law. These include: public participation, development and implementation of environmental policies, law and programs, the enforcement of compliance with environmental law, the provision of environmental infrastructures, the establishment of environmental partnerships, environmental education and environmental information. Du Plessis demonstrates that the governance of long-term socio-ecological change demands a reflection and an assessment of different activities of governments. The analysis of constitutional law, international law and planning could open up directions which are so far not sufficiently explored.

Part II: Economics

What is the role of markets and economic institutions in causing and tackling long-term problems? Targets for income distribution that might be motivated by equity considerations (see last sections) require policy instruments such as taxes, subsidies or tariffs. From an economic point of view, these public policy measures can also be justified through other arguments. First, market failures cause inefficient allocation of resources and policies to remove market distortions (or to introduce institutions that provide the right incentives, such as the internalization of externalities), result in social gains. Second, governments are called upon to enforce at least basic institutions or “formal rules of the game” (Williamson 2000), e.g. secure property rights or contract law (e.g. North 1991).

When it comes to long-term policies, at least further considerations become relevant, namely inter-temporal trade-offs and the long-term stability or permanence of institutions. Some kinds of market failure only occur when time

is considered. Prime examples are common property stock resources or, more precisely, open access resources such as marine fish. Overuse today is motivated by not properly accounting for the consequent losses in the future (Hardin 1968). Distributional policies become a long-term problem when future and current government revenues and expenditures are interlinked, e.g. by public debt or a public pensions system. To sustain the permanence of basic institutions, such as financial capabilities of nation states, a long-term oriented monetary policy will be necessary.

In economic terms, efficient long-term policies are determined by comparing present and future net benefits by means of a discount rate. If the policy can be described by the path of a variable in time, e.g. a tax rate for each year, optimal control methods are available for deriving an efficient path. Additional policy objectives, such as avoiding consumption to decrease over time, can be complemented by formal constraints to the optimization problem. An alternative to this approach is a Rawlsian maximin criterion: maximizing the benefits of the generation that is worst off (see Solow 1974, for an example). In this approach, however, it is by no means evident that all long-term policy goals can be achieved at all. Hartwick (1977) investigates weak sustainability in the sense that aggregate consumption can be permanently prevented from decreasing when production needs a limited natural resource as input. This is only possible if certain properties of the production technology are satisfied. But when a long-term policy is achievable in principle, the question for an appropriate institutional design becomes apparent. We briefly focus on two aspects of the permanence of long-term policy design in the following: establishing/sustaining permanence and dealing with change.

Long-term policies may become obsolete if time consistency is not given (Kydland and Prescott 1977). When there are incentives for deviating from a drafted government plan later, it is not credible that this plan will be actually exercised. Thus, economic actors may not consider the policy in their long-term planning. An example for time-inconsistency is the proposal to limit global warming by sealing fossil resources to prevent the carbon being emitted to the atmosphere (see Eisenack *et al.* 2012). If such a proposal can be agreed upon, the permitted fossil resources would first be extracted for agreed-upon purposes such as research and development – most likely at a higher price, since the resource has become more scarce. Then, however, resource owners would have an incentive to break the agreement and extract the remainder. Public policy would not achieve its goal. A variant of this consideration is the property of coalitions being proof against re-negotiation (Farrell and Maskin 1989) that has been applied to international agreements for climate protection (e.g. Asheim and Holtmark 2009).

In the presence of time inconsistency, reputation or other more formal institutions can restore credibility. Kydland and Prescott (1977) propose to devise fixed rules that “compute” the policy variables in the future depending on the condition at each time. This is the underlying idea of monetary policy institutions such as the European Central Bank. It is set up as a body that has to follow legal

rules, but the decisions are (officially) independent from European governments that otherwise might feel tempted to deviate from long-term objectives to solve, e.g. budget problems.

A less conventional way to establish permanence can be the creation of path dependencies (David 1985; Arthur 1989). In general, path dependencies can occur due to economies of scale and network externalities in sustainable and less sustainable directions. Small differences in parameters or initial conditions of an economic process can then lead to profound differences in equilibria or long-term outcomes. This lock-in of conditions can only be changed at high cost or is stabilized by incentives. Further path-dependencies can be introduced through partially irreversible investments, e.g. long-lasting infrastructures (see Hummel, Chapter 6 in this volume). The mere existence of large projects such as extended solar power plants in the Sahara or the Panama Canal set landmarks for further policy processes. As physical objects they cannot simply be modified by changing power constellations or due to time-inconsistent incentives. Thus, with the right timing, relatively small decisions may kick-off irreversible policy plans and establish permanence. A thorough assessment of the long-term consequences of such investments becomes inevitable to avoid high-regret solutions.

When the institutional system allows for setting long-term policies that become permanent the political economy of drafting policies points at further problems. One crucial difference between market interaction and government policies is that the former are only made, at least in theory, voluntarily when there are gains of trade for all partners, while the latter is coercive (Moe 1990). Thus, lobbying for public policies to promote private interests is a good way to obtain rents or to avoid diminishing rents, but it leads to regulatory capture (Stigler 1971). For a more pronounced expected permanence of the policy, the incentives for regulatory capture are higher. However, if there is the possibility to re-adjust the policy at least from time to time, e.g. after an election period, Moe (1990) warns that there will be a trade-off between policy efficiency and policy stability. To avoid institutions being changed by subsequent governments, complex bureaucratic procedures or path dependencies are built in. That comes at the price that these institutions do not achieve their objectives in the best way. Decision makers will tend to take that price to reduce the uncertainty that the permanence of the institution may be destroyed.

Uncertainty is one example of the problems of dealing with change when establishing or sustaining long-term governance approaches. When making investments in a project with longer life-time but with future benefits depending on a stochastic process, i.e. uncertainty, it is known that there is a premium to wait with investment (Pindyck 1991). By waiting, more information about the uncertain future will be revealed. In analogy to long-term policies this leads to postponing implementation. This effect is similar to the older argument by Arrow and Fisher (1974) that irreversible decisions with uncertain payoffs should err on the side of precaution (see Stecker *et al.* 2011, for a similar argument with respect to adaptation to climate change).

However, when an institution is established in an uncertain or changing environment, change in the environment that was considered as being very unlikely at the beginning might jeopardize the institution. This is even more pressing when there is completely unexpected change. In a game theoretic setting analysing environmental agreements, the payoff functions of actors might change due to new preferences. A technological breakthrough can utterly change the problem that is addressed by the policy or can render the policy unnecessary. When long-term governance solutions are supported by infrastructure with long life-times, efficiency requires anticipatory consideration of (uncertain) effects from global environmental change (Stecker *et al.* 2011). Errors are difficult to correct. There might be misuse from powerful actors (e.g. of facilities for geo-engineering), and there might be inflexibilities being introduced which cause further long-term problems. In short, when a policy was successfully designed to solve an original problem with the permanence necessary to achieve an effective solution, unexpected change in the environment might favor a change of the policy over its permanence. In the ideal case, even permanent institutions are sufficiently flexible to adjust to change. Since the latter is more or less a contradiction, it is likely that there is a similar trade-off as discussed by Moe (1990), i.e. more flexibility may come at the price of less effectiveness.

Long-term environmental challenges such as climate change or the loss of biodiversity require an adjustment in existing political, economic, technological, and social systems. But how should the required adaptation processes look like? Part II: Economics will go into what different adaptive capabilities natural and social systems have. What are the necessary investments and subsequent costs of this process? What are the social and political implications of the different instruments and processes? Additionally, the section will address investments which are necessary today but mainly have effects or benefits in the future.

In their contribution, Stefan Hochrainer-Stigler and Reinhard Mechler investigate the long-term trends in fiscal stress and other sectoral costs from natural disasters in Europe. They focus on the time scale by contrasting immediate and long-term costs and considering sectorally different planning horizons of up to several years in the future. By using a quantitative model, they are able to assess both the direct and the indirect economic burden of disasters. For adapting to climate change, primarily risk financing instruments are considered. These are basically short- or medium-term in nature, since e.g. an insurance premium can be easily adjusted to new conditions. The risk, however, also depends on long-term adaptation, e.g. with respect to land use of high risk areas. As example applications, the authors calculate national flood loss distributions and the expected long-term viability of the European Solidarity Fund for disaster relief in the EU.

The contribution by Diana Hummel, Cedric Janowicz, and Alexandra Lux puts long-living supply systems into the centre of their analysis, with water systems as the main example. Supply systems are considered as boundary objects that require a social–ecological perspective, e.g. by considering the institutional arrangements of users, the technological infrastructure and the natural resource base.

Such systems cannot be easily changed on the short time-scale when conditions change. They interact with other long-term trends such as demographic change. Against this background, the authors identify a set of properties that contribute to the adaptive capacity and sustainability of supply systems. This includes “functionality” referring to the basic ability of service quality, while “adaptivity” is the flexibility to revise past decisions. More fundamentally, “transformation openness” is required to reform or to develop the structure of the supply system. This requires the integration of interested stakeholders.

In his contribution Jan Nill analyses opportunities for the transition of technological regimes from the viewpoint of evolutionary economics. There are critical moments in time during which technological pathways can change in a non-incremental way. In such transitions, path dependencies and technological lock-ins can be overcome. However, even if environmental problems are recognized they are not easily taken into account in economic development. Regulatory interventions are needed to stimulate transitions to environmentally friendlier regimes. Nill distinguishes three different strategic approaches to support such transitions: policies to support the search for new techno-economic guideposts, policies to prepare transition windows and policies to utilize transition windows. He focuses on the preparation of transition windows and suggests different implementation strategies for their accomplishment. Addressing the case of sustainable housing in Germany, he analyses the relevance and the impacts of the strategies to prepare a transition window. In his conclusion, he suggests that an appropriate phase-specific policy mix is desirable which combines framework instruments with appropriately timed impulses. Thereby, state policies can play an important role in shaping niche dynamics and preparing transition windows. Policies have to be, however, adaptive to changing circumstances and will have to remain experimental. Nill calls for further research on the co-evolution of policies and techno-economic regimes to respond to environmental problems. Some first steps are taken, utilizing the multiple streams approach of Kingdon (1995) to understand this co-evolution. However, this is yet rather a heuristic starting point than a full-fledged analytical approach. The joint analysis of techno-economic dynamics and political and social systems has the potential as a bridging concept to enable interdisciplinary research.

Part III: Participation

Another strategy in tackling long-term problems is the inclusion of participatory approaches into governance processes. The particular characteristics of long-term problems such as uncertainty about longer term consequences and future events and the need to decide about the timing of particular policy measures require a broad knowledge base. The inclusion of various societal groups and their knowledge backgrounds could thus be helpful in a reflexive and anticipatory governance mode. Voß *et al.* (2009) highlight the bottom-up elements of long-term governance, e.g. to organize processes of interactive learning between societal actors and policy actors by a mix of instruments. Including young people

and representatives of future generations into societal decision-making processes can help to strengthen the long-term perspectives in the deliberation phase. A number of actors, such as companies, retailers, consumers, governmental and non-governmental organizations also need to be involved in participatory long-term governance processes.

Long-term governance solutions need cooperation between various market actors and a higher involvement of stakeholders in the production and consumption processes on the one side and in policy-making processes on the other side. However, there is always the problem of either too much participation or too little participation causing ineffective or imbalanced outcomes. Well-organized and economically potent groups usually are able to participate continuously and with a stronger role in governance processes than less well-organized groups such as many local non-governmental groups or individual citizens (Fung 2006; Bulkeley and Mol 2003; Pellizzoni 2003). A French student once summarised this imbalance by a slogan on a banner: “I participate, you participate, he participates, we participate, you all participate [...] they profit” (cited from Arnstein 1969: 218). In addition, there is almost always the challenge of how to communicate with and understand each other in participatory processes (Connor 2007).

What is more, not all forms of participation are equally effective. According to Arnstein (1969), one of the participation pioneers, citizen participation and citizen power depend on the level of participation. Therefore, a proper classification of participation is called for by, e.g. asking who is able and allowed to participate, how communication or decision making is structured and how much power is related to participation (Fung 2006). Reisch (2004) argues that specific participatory approaches have had hardly any political influence so far. She refers to examples such as climate change advisory commissions (see also Maggioni *et al.* 2009), open innovation processes to design new products, consumer advisory boards in retail companies, ethics councils and stakeholder dialogues of large companies. Over recent years, participatory elements became more common, e.g. in the development of comprehensive sustainability strategies or when initiating multi-stakeholder processes by both politics and companies (Yates 2008). Processes of stakeholder involvement in governance processes are also becoming more pervasive in the field of long-term problems (Lubell *et al.* 2008; Sabatier and Weible 2007; Zafonte and Sabatier 2004). In addition, the scope of actors involved in these governance processes has been extended. Local communities and civil society organizations have become accepted as legitimate actors in local governance processes. In many countries, commissions and councils have been set up representing a broad range of societal actors. This consultation and the participation of a wide spectrum of societal actors provide a different source of legitimacy to decisions as compared to the rationalization of policy making.

In the social science literature, governance processes including stakeholder participation are widely discussed as a pragmatic reaction to the crisis of administrative rationalism (Dryzek 2005). Other arguments are based on the

decline of public confidence in national governments and the conventional deliberative processes (Renn *et al.* 1995; Rowe and Frewer 2004; Hajer and Wagenaar 2003). Participation is a broadly accepted element of local sustainability in the context of the Local Agenda 21, where it is a crucial condition for developing and accomplishing long-term policy goals. As numerous empirical studies could show, stakeholder involvement enhances ownership of the outcomes of the participatory process by the stakeholders (Fiorino 1990; Joss and Durant 1995; Siebenhüner 2004). Nevertheless, from a long-term governance perspective the question arises to what extent stakeholder integration supports long-term problem solving efficiently. Moreover, it has to be asked whether participation processes are effective in terms of improving the policy output, reducing conflicts and fostering smoother implementation in the long run.

According to Smith and Stirling (2007), each of the actors involved in governance processes has only a limited view of the entire complexity of problems, and a constructive view on elements of the problems. As each of them has restricted capacities to influence outcomes and participating actors need a certain quality (Avelino 2009), it has to be asked how useful participation is and what consequences an increase in the diversity of stakeholders concerning long-term problems has. In addition, there is always the risk that any kind of participation can be misused for reputational purposes and as a tool for retarding decisions. Therefore, the role of participation processes within formal decision-making structures needs to be clarified.

However, a great advantage of participation processes is the possibility of expanding the knowledge base and opening the perspectives on *ad hoc* or continuous communication with citizens (Hart 2007). This can open up sustainability-oriented learning as well as behavioural change with many actors.

Having been hailed as one paradigm of the twenty-first century, the notion of “power of consumer citizenship” highlights the active role of citizen participation in governance as well as in consumption and production processes (OECD 2009). Therefore, the education of diverse stakeholders and citizens as well as training general skills and sustainability are necessary preconditions. Nonetheless, as important as participation and learning processes with respect to long-term policy are, as important is their effectiveness in terms of improving the policy output, reducing conflicts and strengthening implementation (Maggioni *et al.* 2009).

In Part III, interactive elements for strengthening and fostering sustainability-oriented long-term governance will be analysed. Questions in this section focus on how different actors from private and civil society backgrounds could effectively integrate long-term policies and what the potential consequences are, particularly regarding legitimacy, accountability and democratic transparency within political processes. Thus, a critical reflection of the possibility of “too much” participation is the focal point of this section. How effective is the increasing participation of various actors in long-term governance approaches? What positive and negative consequences might an increase in the diversity of stakeholders have on effectiveness, transparency, and legitimacy?