

Steering for Sustainable Development – A typology of empirical contexts and theories based on ambivalence, uncertainty and distributed power

Jan-Peter Voß, Jens Newig, Britta Kastens, Jochen Monstadt, Benjamin Nölting

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1 Introduction

Questions about the possibility to steer societal development, i.e. control its dynamics in order to bring about desired future states of society, have come up high on the agenda with the issue of sustainable development. Not that they had been resolved in previous discussions, but something like a truce had emerged from spirited struggle between opposing camps of rational strategists and sceptic evolutionists that took place throughout the last quarter of the twentieth century. An implicit compromise beneath it could be formulated as “actual control is not possible, yet it is still being attempted and sometimes and somehow it actually seems to work – at least for particular segments of society and confined criteria of success”. A parallel development took place in discussions with respect to political steering on the level of nation states as well as with respect to the organisational steering in business in administration.

The field is stirred up by a provocation contained in the concept of sustainable development. The concept articulates a utopia. It calls into question ideologies of progress and everyday practices along the trajectory of modernisation as we know them from the beginning of industrialisation some 200 years ago. This immediately prompts a question: can fundamental trajectories of societal development be deliberately changed, at all? Or is the concept of sustainable development not even worth the effort of further defining it, because it can, in any event, not be realised? We pick up this question in this article and attempt an answer by having a close look at what it actually needs to pursue any such thing like steering societal development. Against this background we find that steering sustainable development takes place in many different contexts which entail different degrees of complexity and possible hurdles for successful steering. We can therefore ask a more differentiated question: What particular problems of steering for sustainable development occur in particular situations? How can these problems and combinations of problems be understood and dealt with?

When we have a look at existing theories of steering, we find different approaches to understand the relation between intended control and ongoing developments. Accordingly, they issue different assessments of the possibility for success and give different recommendations to actors. Most theoretical discussions repudiate a simple hierarchical control model. Charles Lindblom issued the provocative statement on the rationality of ‘muddling through’ and proposes a sober view on the messiness of real world policy-making that leads into strategies of reflected incrementalism instead of grand designs (Lindblom 1969 [1959]; Lindblom 1979). The steering implications of the functional differentiation of society had which had been carried to the extremes by Niklas Luhman introduced some deep scepticism especially in the German speaking social science community (Mayntz 1987; Luhmann and Scharpf 1989; Willke 1992; Jessop 1997). Insights imported from complexity theory left another important imprint on policy and management theory, shifting attention to non-linear dynamics of self-organisation and emerging order (Dörner 1989; Dobuzinskis 1992; Stacey 1996; Axelrod, Cohen 2000; Vester 2003 [2002]). Most recently, theories of co-evolution and network interaction that have been developed in the study of socio-technical change have come up with elaborated shaping strategies that refrain from unilateral control in favour of interactive learning (Rip 1998; Rotmans et al. 2001; Rip, Groen 2002; Rip 2006). More examples could be cited. Any kind of synthesis into a general theory of steering in and of societal development, however, proves impossible. This is, because of differences in fundamental and often ontological assumptions about the structure and the dynamics of the (social) world. Steering theory depends on the conceptualisation of ongoing change and dynamics of transformation.

In spite of theoretical struggle, however, steering has remained as important as ever in practice. No politician or manager who, in advertising her programme, would admit that she sees no way to actually realise it. Neither would anyone, in looking back on a legislative or business year or a personal career, concede that all the good things happened completely acciden-

tally. And despite the marked fuzziness of the concept of sustainable development and the scepticism about capabilities to attain it, we see a great diversity of activity that has started to infuse it with life – on the level of international politics as well as local life styles and production practices. It seems that despite a lack of robust knowledge on whether and how steering is possible, it is still being done.

A starting point for this paper is that not only concepts, theories and strategies of steering are very different, but also the actual contexts in which steering takes place. The diversity of steering theories is therefore not a problem but an asset for developing society's capacity to deal with its own future. We would like to postulate that different steering theories contain useful conceptualisations of different facets of societal reality. What is needed, in order to make use of this potential, however, is a method to systematically relate theories to empirical steering situations to which they apply. There may be situations which allow for central planning and control, and there may be others in which not much more than reflected drifting in the stream of ongoing dynamics is possible. This article is an attempt towards a more systematic investigation of the issue of "matching steering theories with steering situations".

To this end, we first work out basic elements of steering (i.e. goals, knowledge, power) against the background of sustainable development (Section 2). In this we find that goals, knowledge, and power resources can easily become fluent and indeterminable when one deals with problems of sustainable development. This highlights fundamental limits to steering and requires rethinking conventional ideas of rational planning and control. However, these limits are not the same in each and every situation. Different contexts therefore require different steering approaches. We propose criteria by which the degree of ambivalence of goals, uncertainty of knowledge and distribution of power within a given context can be assessed. Variations of the degree of complexity within each of these dimensions are at the basis of a typology of different steering contexts.

In a next step, we present a review of selected steering theories that contribute to the discussion of sustainable development (Section 3). The review carves out assumptions about the possibility to define goals, obtain certain knowledge, and concentrate power resources in order to control system change. The result is presented as a set of clusters which represent five different combinations in which theories problematise ambivalence of goals, uncertainty of knowledge, or distribution of power.

The typology together with the theory review allows us to match types of steering contexts with suitable theories of steering (Section 4). A particular type of steering situation can be identified with the held of criteria for ambivalence of goals, uncertainty of knowledge, and distribution of power. For each type of context there is a specific set of theories that offers useful understanding and strategy recommendations.

In concluding the paper we discuss the achievements of our approach to answer steering questions of sustainable development (Section 5). One central point that we want to make is that a differentiated view on steering situations and theories may offer new alleys for theorising and practical experimentation. A general "yes or no" with respect to the possibility of steering sustainable development can be substituted with a specified "it depends".

2 Classifying steering contexts

In order to provide a semantic anchor for the following discussion, we start with a working definition of steering as *a purposive attempt to bring a system from one state to another by*

*exerting influence on its dynamics of development.*¹ This definition presupposes the differentiation of a subject and an object of steering (the steering actor, however, may be part of the system to be steered). Steering does not imply that goal-oriented influence on system dynamics is successful; the relation between intention and outcome is rather a central concern in steering theory and practice (with these specifications we closely follow Mayntz 1987: 91-95).²

So defined steering takes place in different social settings and on different levels of societal organisation. Public policy on different levels plays an important role, but it is not the single most relevant form of steering in society. Steering also takes place within organisations such as business companies, non-profit organisations and administrative agencies. Apart from these formal and comprehensive modes of steering in policy and management, there are complementary and interfering actions that are equally aimed at bringing societal systems from one state to another. These are, for example, the writing of journalists who intend to shape public discourse, the work of scientists who aim to establish problem definitions and expectations, public mobilisation of environmental organisations aiming at a consumption boycott, or negotiations between companies who agree on common standards of performance. In the following we put a focus on political steering as the most prominent addressee of public expectations with respect to sustainable development. Most of our examples are drawn from this area. In terms of conceptual work, however, we aim at presenting considerations that apply to different forms and contexts of steering.³

Conventional concepts and strategies of steering rest on the assumption that the following preconditions can be met:⁴

- Decisions on value trade-offs are taken in order to *determine goals*.
- Knowledge on system dynamics is at hand in order to *assess options for action*
- *Power to control* relevant factors that influence system development is given.

In considering steering contexts for sustainable development the possibilities to secure these preconditions are called into question (Voß and Kemp 2006): Sustainability goals are inherently ambivalent. Knowledge about the dynamics of coupled social and ecological systems is uncertain (if it is not ignorance that prevails). Power to shape fundamental social changes is distributed all over society. At first, this causes discomfort and confusion, because any reliable anchor for developing steering strategies is lost. How shall steering be possible, if not even the goals are clear, nor can the consequences of action options be predicted, let alone the lacking capacity to implement what may be regarded as a useful strategy? On second sight, however, this situation offers an opportunity to systematically recapitulate concepts and

¹ We use the term steering, because it refers to the requirement to change course which is embodied in sustainable development. We understand it to be a more general notion than controlling, guiding, or shaping which each imply a more specified understanding of system dynamics and how they are influenced.

² We feel that these provisos are in place because in some respects the notion of steering has been blurred so far as to include any kind of coordination and order in interaction processes, even if it “accidentally” results from spontaneous self-organisation without any discernible attempt at goal-oriented shaping.

³ This definition of steering relates to governance in the following way: the governance of a societal systems is the interplay of various forms of steering by different actors within their respective (institutional) contexts and the emerging patterns of interaction that result from it. Governance comprises steering and steering is embedded in larger governance structures and dynamics. Their relation can be understood as a micro-macro relation.

⁴ Most often, these assumptions are implicit. They are explicitly stated in project rational planning guidelines, management handbooks and the like. A similar threefold distinction of problem dimensions is used in methodologies of transdisciplinary sustainability research (MOST Project 1997; Thompson Klein et al. 2001).

strategies of steering. Sustainable development draws attention to basic preconditions of steering because their fulfilment can no longer be taken for granted. Defining goals, analysing system dynamics and building coalitions cannot generally be considered a task of skilful crafting, but often meets fundamental boundaries which have to do with the kind of problem that we are facing. Sustainable development involves heterogenous values, complex dynamics and macro-social change. This is where established methods of instrumental rationality have to pass.

For our purpose of differentiating conceptual discussions of steering, however, this situation offers a starting point. It reveals three basic dimensions of steering which can be used to describe and classified steering contexts as well as steering theories. The ambivalence of sustainability goals (2.1), uncertainty of knowledge about system dynamics (2.2), and the distribution of power over factors that influence system development (2.3) can serve as variables for a typology of steering. In the following paragraphs, we take a first attempt at conceptualising these three dimensions of steering in more detail. We propose a set of criteria for each dimension in order to position any given steering context on a continuum between simple (value '0') and complex (value '1').⁵

2.1 Ambivalence of sustainability goals

Sustainable development is often referred to as a normative orientation. Especially when it comes to the question of what sustainability means in practice, and what it specifically seeks to achieve, the concept is affected by its inherent subjectivity and ambiguity (Kates et al. 2005: 12). Thus, to reach agreement by actors from different perspectives on the particular conditions of a problem area, sector or system that are considered as sustainable usually requires a long negotiation process (Grosskurth and Rotmans 2004: 138). Often, there is simply no way to get there, at all.

Yet, even though the discourse on defining sustainable development is highly value-laden, the concept has a functional condition at its core: it sets the condition that development should not undermine itself in the long run. The concept is thus normative to the extent that it implies a value decision to sustain societal development on earth rather than to annihilate it. The norm is, in this sense, intergenerational equity. On this level of abstraction, there is, not surprisingly, overwhelming consensus. But the crucial question for real world governance is: which kind of instruments, practices and system structures are needed to sustain societal development? In steering for sustainable development, this question is linked to well-known disputes about the operationalisation of sustainability for assessing concrete technologies, policy options, and system structures. Due to the impossibility of deriving an answer in an objective and unequivocal manner, divergent values and risk perceptions come into play here (Stirling 2003). In practice, defining sustainability involves, therefore, trading-off different social goals against each other – even though there is no general currency through which this could be done (cf. Becker 1997: 6ff.). This introduces a fundamental ambivalence of goals into steering

⁵ Information and complexity theory have developed different measures such as Shannon entropy or algorithmic complexity to determine and quantify complexity, randomness, uncertainty and heterogeneity (see Zurek 1990; McAllister 2003). Following a custom that emerged from this work, we employ a numerical scale ranging from 0 to 1 to demarcate the level of complexity in the three dimensions of steering. "0" stands for simple, clear, structured or well-controllable situations. "1" denotes complex, heterogeneous, indistinct, ambivalent, diversely structured, uncertain or diffuse situations. We are aware that a proper quantification is hardly feasible. Yet, the measure allows for a handy distinction of complex, medium-complex and simple values in any of the dimensions. As a general rule, the more complex a steering context is in any one of the dimensions, the more different elements are needed to properly describe it.

for sustainable development; sustainability often is a matter of “as well as” (e.g. efficient and socially just and ecologically sound) rather than “either or” (Beck 1993).

However, there are situations with different degrees of ambivalence. Cost-effective exploitation of energy efficiency potentials is, for example, a clearly-defined and undisputed goal. The question what a sustainable overall structure of energy provision would look like, on the other hand, entails all kinds of difficult questions, such as trading off technological risk of nuclear energy or aesthetical nuisances from windmills against greenhouse gas emissions from coal-fired power plants, to give an example. In order to be more precise about the conditions that make sustainability goals within a given steering context more or less ambivalent, we distinguish two aspects: conflict between contending definitions of sustainability and the vagueness of sustainability goals that have already been agreed upon.

Conflict of goals. As people hold different values (and change them over time), they apply different criteria and appraise options differently, and make different decisions. Even if everybody generally agrees about what is good and what is bad, there may be differences in how certain values are ranked – and weighed in decision-making. This is especially relevant for sustainability assessment since equally legitimate goals can only seldom be achieved simultaneously and to the same extent. What, for instance, are the consequences, if targets of the Habitat-Directive contradict those of the Water Framework Directive? This might be the case for the biological status of an aquatic ecosystem, where one species demands clear, open habitats, while the other needs muddy and sandy areas. In this case, the operationalisation in the sense of one directive might contradict another. Other examples of conflicting goals are alternative visions of sustainable energy provision, one based on nuclear energy, the other on renewables. This example shows how ambivalent goals are closely connected to risk assessment. Evaluations of what an acceptable risk is differ greatly between actors and contexts and cannot be determined exclusively under scientific aspects (Stirling 2006).

Ambivalence of goals might be a frequent phenomenon in governance for sustainable development, but it does not have to be symptomatic. Even with issues where basic value structures of political groupings are involved, particular sustainability goals can be consensual. Social debate about the depletion of the stratospheric ozone layer has quickly led to an overarching consensus to fade-out the production and use of chlorofluorocarbons (CFCs).

Depending on the number of differing sustainability goals, conflicting parties and the degree of conflict within a given problem context – as indicated by statements of politicians, interest groups or in press articles – goal ambivalence varies between low (0) and high (1). The ambivalence of goals is likely to be higher the more encompassing the addressed changes are, i.e. the larger the scale and the wider the boundaries of the systems in focus as well as the distance from actual political and economical situation and given systems of values to demanded changes.

Vagueness of goals. Even if no acute conflict is apparent, goals may prove ambivalent, if they are not mapped out specifically enough (e.g. in terms of focus, quantification and time scale) to serve for discriminating between concrete options for action. This situation often arises when goals are derived from preceding collective decision-making processes, such as laws, or governmental declarations. Due to external pressures to achieve formal consensus, these goals often cover underlying conflicts, which are still unresolved. They leave room for interpretation and thus postpone concrete decisions, e.g. by employing symbolic phrases everyone agrees to but which are, intentionally or not, impossible to operationalise in practice (see Newig 2004).

Much of EU legislation, such as the Water Framework Directive, contains this kind of goals, as, for instance, the goal to attain a “good status” of all European water bodies until 2015. The

vagueness of this goal, which is hardly contentious at the scale of the Union, leads to disagreements on lower scales as a clear definition of the term ‘good status’ is missing (Johnson 2001: 2). Its measurability thus depends on local conditions and will be difficult to operationalise in particular cases (Newig et al. 2005). Ambivalence of goals would, in this case, be quite high (close to 1), since possibly conflict-intensive negotiations are required at lower policy levels (member states and regions) in order to arrive at a definition that can be an orientation for actual practices of water use. The more contradicting objectives can still be subsumed under a given sustainability goal, the more ambivalent it is.

Yet, a politically-defined sustainability goal can also be clearly expressed, unambiguous and not have much room for divergent interpretations. In this case, ambivalence is very low (close to 0). For instance, in November 1990 the German federal government declared the target of reducing the German emission of CO₂ by 25 % until 2005 as compared to 1990. This goal is measurable and it is clear when it must be met (whether this is realistic, or how it should be implemented, is a different question).

The operationalisation of the sustainability concept necessarily remains contested and must be understood as a moving target. The social perception of the sustainability of certain practices, and the socio-ecological system dynamics in which they are embedded, changes with developing public discourse and scientific knowledge production. Although sustainability goals can neither be generated from universal norms or moral systems nor by scientific prognosis and risk assessment, an increase in what is regarded as certain knowledge about socio-ecological system dynamics can decrease their ambiguity. Thus, uncertainty, which is treated in the following paragraphs, is one source of ambivalence in goals.

2.2 Uncertainty of knowledge about system dynamics

Besides the ambivalence of goals, sustainability problems often suffer from informational complexity and uncertainty (Newig et al. 2005). Since the Club of Rome’s “Limits to Growth” (Meadows et al. 1972), along with the methodological criticism it has experienced, there has been a rising awareness that what we now call sustainability problems tend to be of a complex nature, full of non-linear interactions and interdependencies, and therefore difficult to predict, the more so, as one has regularly to deal with unintended effects. Such problems are consequently difficult to govern (Dörner 1989; Vester 2003 [2002]).

Sustainable development as a policy goal focuses on long-term dynamics of socio-ecological systems in a global context and transgresses traditional knowledge domains. Social, economic and ecological issues are often intricately intertwined. Many sustainability problems extend well beyond the scope of disciplinarily-defined problems and the cognitive models that are used to understand them. The ecological and health effects of certain ways of industrial production or life-styles are usually not visible (such as chemical or radioactive pollution) and cannot be experienced in daily life (Beck 1986). Scientific methods of measurement and interpretation are necessary intermediates to detect and monitor changes in the environment and the effects of actions (Eder 1997, 41). But also science often fails to develop a thorough understanding of underlying mechanisms. An example which portrays different kinds of uncertain knowledge is the issue of BSE/vCJS (mad cow disease). First, the infection of cattle from feeding on meat and bone meal was unknown and unforeseen and had to be reconstructed after the phenomenon had appeared. Second, the risk for humans of coming down with vCJS is still subject to scientific dispute; accordingly, there is uncertainty about the need to take protection measures. Third, there is high uncertainty about the effect of different policy options (such as import bans, culling, testing) that could help solve the problem (cf. Dressel 2002).

Due to complex interactions across society and nature, the understanding, explanation, and analysis of the problem of sustainable development becomes a problem in itself. Following from this cognitive difficulty in understanding sustainability problems, a key challenge of governance for sustainability lies in the fact that it is unclear how a sustainability goal can be reached. To put it differently, the effects of proposed interventions are typically highly uncertain, given that the causal relations and dynamics of the system at issue are poorly understood.

Acknowledging that many sustainability problems are of a complex nature, we do also see that not all share the same degree of complexity and uncertainty. Two criteria can be proposed to distinguish different degrees of uncertainty with respect to the dynamics of the system with which one interacts in implementing steering strategies. The higher a given steering context scores in each of these criteria, the closer it gets to the value of '1' as opposed to '0'.

Heterogeneity of interacting factors. Generally, a problem is considered complex, the more attributes, elements or variables are required to sufficiently describe the problem, and the more scientific disciplines are affected. A special aspect of sustainable development problems is that they often comprise interaction between very different elements from the domains of society, technology and nature (van den Daele 1996). Apart from the very different dynamics by which these elements change, it must be understood how they interact with each other and feed into larger socio-ecological patterns of development. In case a problem cannot analytically be isolated from its context, disciplinary-structured knowledge is of limited use. In order to get a hold of dynamics which are important for the governing of sustainable development, 'knowledges' from different domains and disciplines need to be brought together and linked up with each other. Methods for problem-oriented transdisciplinary knowledge production have only very recently begun to be developed (Hirsch Hadorn et al.; Hollaender et al.; Nölting et al. 2004; Bergmann et al. 2005). However, here, some problems are also more complex than others. Shaping the dynamics of change within a small, hierarchically-structured organisation requires understanding the interaction of less and more homogeneous factors than shaping structural change in the energy system, for example. The first case would therefore imply lower uncertainty about effects of steering actions (close to 0) than the second one (close to 1).⁶

Feedback loops and emergent dynamics. Besides the number and heterogeneity of elements that are involved, a specific quality of problems is given by the way in which elements are interconnected, i.e. how the system is structured. This refers to the density of interconnections and mutual influences which create feedback loops. If overlapping feedback cycles play a great role in system change, its dynamics become non-linear and less predictable. Systems then exhibit contingent dynamics of self-organisation and emergence. Time lags, many indirect effects, (latent) instabilities of systems behaviour, chaotic changes, path-dependency of development and a high sensitivity to initial conditions make intervention a very precarious endeavour (Prigogine 1979; Shackley et al. 1998; Urry 2005). Such complex dynamics do not characterise each and every system context of steering for sustainable development, however. Many processes show much simpler patterns for which dependent (effects) and independent factors (causes) can be analytically separated and the outcome of reducing or increasing the value of causing factors can be predicted with satisfactory certainty.

⁶ Another example from environmental protection are two problems of air pollution: sulphur dioxide (SO₂) and tropospheric ozone (O₃) in industrialised regions. The latter exhibits a much more complex pattern due to a multitude of emission sources, a strong dependency on weather conditions and different kinds of temporal variabilities following the daily cycle of solar radiation and the daily and weekly cycles of car usages. The former, on the other hand, stemming mainly from large coal-fired power plants, is much more evenly distributed and predictable in its dynamics (Newig 2004).

Whereas the number and heterogeneity of interacting factors can, in principle, be dealt with by assembling information and networking different knowledge sources (Newig et al. 2005), emergent dynamics imply irreducible, ‘radical’ uncertainty (Pellizzoni 2003). In the end, problem complexity also depends on how the problem issue and its scope is framed (see Nölting et al. 2004). For instance, the German “Waldsterben” problem of the 1980s was framed by scientists as a highly complex issue due to the multiple effects of acid depositions on plants, chemical reactions in the soil and so forth (high uncertainty). Public and political debate, on the other hand, presumed a straightforward causal relationship in the sense that industrial pollutant emissions cause acid rain which in turn causes forest damages (low uncertainty) (see Newig 2004).

2.3 Distribution of power to shape development

Irrespective of the ambivalence of goals or limited knowledge, the question of how to implement developed strategies still remains. This refers to the distribution of capacities to implement sustainable development. According to what is discussed with respect to mobility, food, housing, energy etc., this involves deep structural changes. Such changes result from the interaction of many different factors and processes, such as scientific and technological development, market strategies of firms, public policy and regulation, interest group politics, public discourse, life styles, cultural attitudes, demographic change, just to name a few - and they take very long time spans to unfold. The capacities to influence this kind of structural change rest with a broad range of heterogeneous actors who have different problem perceptions, values, ideas and interests about what to do. Coordinating activities within scientific research fields, technological innovation networks, big companies, governments, associations and millions of households is difficult enough. Coordinating activities across these diverse fields is what would be needed to implement strategies for the shaping of societal development. This view on the sources of influence on societal development throws light on the different places at which steering for sustainable development has to take place – and indeed is taking place.

This diversity is connected to particular steering contexts, which can show varying features with respect to the distribution of power to implement steering strategies. For many problem settings of sustainable development, control capacities are highly distributed. This is particularly the case when they touch structural transformation of whole sectors of society as in the case of strategies for sustainable mobility, agriculture or energy systems. Overarching competencies and procedures for controlling the different activities that are relevant in exerting influence are not established. Distribution of power is therefore high. In other cases, like the introduction of new product policies within companies, power can be more concentrated with a few managers. In these more hierarchical settings, distribution of power is lower (even if product policies can still be obstructed by employees of lower hierarchy levels).

For a more detailed analytical classification of steering contexts with respect to their features in the dimension of power, we can distinguish between horizontal distribution of power and vertical distribution of power.

Horizontal distribution of power: An example of a case in which the horizontal distribution of power is high (close to 1) is the development of a long-term energy strategy. Here, very many actors of different social contexts like several ministries, utilities, technology providers, environmental and consumer associations and research institutes need to work together to make an effect. None of the roles is hierarchically superior in the sense that it can unilaterally determine the actions of others. An example for horizontally-concentrated power (distribution low, i.e. close to 0) can be the realisation of an eco-management and audit scheme in a company. Even if the eco-audit must be coordinated between different members of staff the interorganizational interplay between different departments or between different companies is rather low

and the management may have considerable power resources to coordinate implementation process. Indicators for the degree of horizontal distribution of power are the number of policy fields, different organizations, or actor groups involved in the implementation of steering strategies in combination with differences in power resources that they can dispose of.

Vertical distribution of power: Vertical distribution of power refers to interdependencies of steering activities on different levels of governance, such as policy-making on the level of the European Union, national governments, regional states and local municipalities – or the coordination of business strategies on the level of general industrial associations, sector specific associations, on the level of single companies and departments within a company. Here, steering can also take place in contexts in which general framework regulations are set by higher levels that are specified and enforcement at lower levels. An example is policy-making on higher education in Germany which needs to be aligned with the implementation of European standards for mutual recognition of academic degrees, the competencies of German Bundesländer to set legal frameworks for universities and the implementation in terms of particular organisational structures and curricula by the universities and their departmental management structures. This case would be classified as one with a high degree of vertical distribution of power (close to 1). On the other hand, there are contexts in which steering is happening more or less independent of higher or lower levels of governance. Procurement and investment strategies in private companies, for example, are implemented relatively free of interference from other governance levels. These cases may be classified as being low on vertical distribution of power (close to 0). An indicator for the vertical distribution of power thus is the number of different policy of management levels that are involved in implementation and the relative influence that they have on the outcome of steering.

Steering development through public policy? (Excursion on the role of the state)

An important steering actor for sustainable development is the state. It has traditionally been assigned the responsibility for taking care of collective problems and guiding societal development into desired futures. Over the last decades, however, the exclusive role of the state and reliance on its power to steer development have been eroded. Globalisation and specialisation in different functional domains of society play an important role, as well as the particular problem structure of sustainable development as compared to conventional understanding of environmental problems. The framing of environmental problems like air and water pollution in many cases allowed for central steering and a top-down oriented implementation structure of emission control policy. In contrast to this, the call for integrative problem-solving that accompanies sustainable development challenges traditional models of policy-making. The model of a sovereign, unitary and autonomous state on the one side, and the addressees of political steering being sensitive towards regulatory pressure on the other side, turns out to be a too simple construct. Analytically, two main reasons can be differentiated: increasing dependence on private actors and diffusion of public policy-making across several governance levels, policy domains and territorial jurisdictions.

Distribution of power between different social systems

Problem-solving resources for sustainable development are often controlled by a multitude of private and public actors and social groups in various subsystems, whose behaviour cannot be controlled by the state. In contrast to traditional environmental policy, which was framed as emission control, hierarchical forms of governance prove insufficient for precautionary risk management and sustainable resource management. Precautionary measures and sustainable flow management cannot rely on the definition of universal legal standards, the enforcement of law by decentralized supervisory authorities, and on the sanction of individual activities in case of contravention. For example, climate policies do not address single operators of power plants alone. Instead, by promoting the efficient use of energy and renewable energy resources the state is dependent on the performance of diverse social systems and on individual practices in numerous demand sectors. Similar developments can be observed in the agricultural sector, in the transport sector, in waste sector etc. where sustainability policies predominantly depend on social resources in different social domains, which cannot be imperatively controlled, disposed or affected by

the state (cf. Grimm 1994: 627). The risk production of modern societies by driving (inefficient) cars, refusing eco-products, using inefficient electric appliances etc. is mainly based on activities of autonomous actors embedded in life-styles and established institutional structures. Thus, the resources for risk prevention and the power to shape structural change towards sustainability are highly decentralized and distributed across a multitude of societal subsystems. In other cases, private addressees of political steering are highly self-organized which enables them to resist political steering. The majority of corporate and private decisions on sustainable agriculture, energy or transport systems defies hierarchical public control and cannot be guided directly by the state. Thus, the way in which public policy is implemented, changes (Mayntz 1996: 157). As the power to shape structural change in society is, in many cases, distributed across a multitude of private actors and societal subsystems, traditional concepts of centralized intervention and hierarchical steering have to be replaced by new concepts of indirect guidance, coordination, participatory decision-making which allow for learning, collective action and self-organization (Kaufmann 1994: 31).

Distributed control across policy levels, policy domains and territorial jurisdictions

The concept of centralized control exerted by a sovereign state is not invalidated alone given the growing dependency of the state on other social systems. The state is increasingly characterized by a plurality of actors and subsystems, which do not perform according to a consistent, unitary perspective (Mayntz and Scharpf 1995: 9). The novelty is not so much that the state must be seen as a complex multi-organizational actor system. It is that the differentiation of new policy fields and levels has recently been amplified rapidly and relationships between the different public organizations have been intensified (Grande 1995: 328 f.).

For instance, environmental policy has been established as an additional policy field with a specialised environmental administration, legislation, parliamentary committees, associations etc. influencing the policy process at every political level. Especially the development of environmental policy towards sustainability policy intensifies the necessity for environmental policy integration and *horizontal coordination*. In traditional environmental regulation, once environmental regulations were defined, the enforcement of emission standards in power plants, sewage plants etc. was organized mostly independently from other policy domains and the need for interpolicy-coordination was comparatively low (cf. Monstadt 2004: 155). The success of climate, biodiversity, integrated water resource policy, however, depends primarily on changing practices in policy fields like energy, transport, economic, building, agricultural, research, foreign policy etc. Many sustainability policy problems overarch several policy sectors, entailing what Rhodes (1997: 13) terms a "policy mess", characterized by policy coordination problems, conflicts between government departments backed by their respective policy communities and legitimization problems.

Additionally, the *vertical coordination* and the interlocking of politics (Politikverflechtung) between different policy levels have recently become more complex. In particular, the globalization of ecological problems and the internationalization of economic activity created an "institutional void" (Hajer 2003), calling for supranationally-accepted rules, norms and procedures according to which politics is to be conducted and to which policy measures are to be agreed upon. In addition to this, sustainability policies are also challenged by an interlocking intranationality. Contrary to the traditional regulatory model, the division between centralized rule-making and decentralized monitoring and enforcement lapses if regional and local policies have to provide for innovative milieux instead of implementing national standards.

Finally, due to interdependencies between different territorial entities, new forms of bilateral or multilateral cooperation between nation states, between regions or between municipalities have emerged across traditional territorial borders. Examples of these emerging *governance contexts across territorial jurisdictions* at different spatial scales are neighboring municipalities cooperating in climate protection and developing regional innovation networks, riparian regions institutionalizing interregional or international commissions of river basin management or functional networks of nation states in developing technologies etc.

Thus, sustainability policies have to consider the differentiation and the complex interlocking of different policy levels, policy fields and territorial entities (cf. Benz 2000: 98). In decentralized, federal policy structures, decision-making depends increasingly on negotiations in multi-actor-systems and has to cope with multiple veto players (ibid.). Distributed control capacities within the state have to be taken into account in strategy development for sustainable development. Increasingly, public interests can only be protected through increased coordination across policy sectors, policy fields and territorial borders.

2.4 Typology of steering situations

On the basis of the foregoing discussion we can think of different ways in which ambivalence of goals, uncertainty of knowledge, and distribution of power combine in steering for sustainable development. Table 1 gives a first outline of a typology of steering contexts that can be derived from it. It contains types of steering contexts that combine different degrees of complexity in the dimensions of goals, knowledge, and power.

Type of steering context	Ambivalence of goals	Uncertainty of knowledge	Distribution of power	Description
Full Control	Low (0)	Low (0)	Low (0)	Complexity is low in all dimensions of steering. Goals can be unequivocally defined, knowledge allows for safe prediction of action consequences, and the actor disposes over power to control all relevant factors to influence system change (example: government increases air quality by commanding flue gas filtration in industrial plants)
Value conflict	High (1)	Low (0)	Low (0)	Knowledge about developmental dynamics and effects of action is available, power to bring about relevant system changes as well, but goals are highly ambivalent, the general direction which development should take is disputed (example: decommissioning of nuclear power plants)
Blind Goliath	Low (0)	High (1)	Low (0)	Goals are clearly defined, power is all in one hand, but there is very little knowledge on how the system works and what effects of alternative action options will be (example: natural park administration manages their territory as to maintain ecosystem stability)
Collective action problem	Low (0)	Low (0)	High (1)	Goals are clear and undisputed, it is known how things work and what would be effect of alternative actions, but power to make a change is distributed across many actors that cannot easily be coordinated (example: commuter seeks to avoid getting stuck on congested roads)
Disoriented Power	High (1)	High (1)	Low (0)	Power to take the system to any future state is all in one hand, but neither is clear what a desired state would be, nor how the system works and what different actions would have as consequences (example: a moronic dictator issues decrees and spends money arbitrarily)
Utopia	Low (0)	High (1)	High (1)	The desired system state can be clearly defined, but neither is knowledge available that would tell one what to do, nor are power resources at hand to take actual effect on system development (example: fighting summer smog by symbolic policies in order to cover lacking capacities to reduce detrimental effects of automobility)
Clash of interests	High (1)	Low (0)	High (1)	Knowledge on how system works and what would happen if certain actions were implemented is available, but different goals for future system development stand in conflict and are backed by relevant societal powers (example: extension of public transport)
Awkward Drifting	High (1)	High (1)	High (1)	Goals are highly ambivalent, knowledge is uncertain and power to take influence is distributed. Yet, there it is acknowledged that current development trajectory is hazardous and has to be changed (example: global policy making on sustainable development)

Table 1: Typology of steering situations

3 Theories of steering, their assumptions and strategies

In the following section we have a closer look at steering theories. What does scholarly discussion of political and societal steering offer for sustainable development? We are particularly interested in how steering theories account for the problems of ambivalence, uncertainty, and distributed control as they have been outlined above, and what strategies they offer to cope with these problems. For this purpose we analyse a selection of much cited steering theories with respect to their implicit or explicit assumptions about the definition of goals, knowledge on system dynamics and the power to implement steering strategies. We find that steering theories differ remarkably in this respect. For the selection of theories which we went to scrutinize it turns out that a classification along the lines of our problem dimensions serves well to generate clusters which bundle related theories according to main characteristics. The following review is presented in this way.

We discuss five clusters of steering theory which are characterised by specific assumptions about the context in which steering takes place. A first cluster does not much problematise steering from a theoretical point of view, but considers steering mainly as a matter of technical skills in crafting rules for social interaction. A second cluster of theories puts a focus on the problem dimension of goals. The definition of goals and guiding visions are considered as key challenges for sustainable development whereas knowledge and power remain in the background. A third cluster is explicitly concerned with knowledge problems in steering and acknowledges the limits imposed by uncertainty about effects. It proposes diverse ways of searching for unknown solutions in open-ended processes of social learning. A fourth cluster highlights the third problem dimension of distributed power to implement steering strategies combined with heterogeneous interests of actors who hold power. Theories in this cluster emphasize the need for strategic collaboration and network building in order to coordinate and link social sources of influence. A fifth cluster, finally, gathers a bundle of theories which are based on a far reaching problematisation of steering which covers all three dimensions. These theories often avoid the notion of steering altogether and advocate procedural provisions to modulate emergent dynamics in social self-organisation. The following paragraphs discuss these characteristics with reference to corresponding literature.

3.1 Steering through regulation: Crafting rules

A first cluster of theories takes steering as largely unproblematic – at least with respect to the more fundamental issues raised by ambivalence of goals, uncertain knowledge and distributed power. Theories in this cluster understand steering as a matter of skilful rule drafting. One classical type are command-and-control approaches to governance. They assume a powerful state as a central actor, having extensive steering knowledge, being able to define unequivocal goals and having effective steering resources. Another, more recent type are economic instruments. Here, some leeway is given to market dynamics in order to allocate scarce resources, such as the use of environmental goods, to particular users in a cost efficient way.

The basic concept of the command-and-control in environmental policy approach is to specify the concrete actions that individual polluters must take to solve a problem (Holzinger et al. 2002: 2, Gawel 1994: 9). In this approach environmental problems are perceived as simple structured problems, which are controllable and resolvable through police law and with technical measures. Command-and-control measures are top-down oriented. They are characterised by an intervention or regulative control intend of the government to achieve a target (Holzinger, et al. 2002: 2, Gawel 1994: 9), as it is known from the Weberian bureaucracy model (Nahamowitz 1995: 119f. Cited in Zerle 2004: 14).

Even though economic instruments show a wider variety of concepts (ranging from taxes over fees to tradable certificates), the basic understanding of steering is similar as that of command-and-control approaches. Especially in the case of traditional economic instruments, such as water fees or tax allowances, the concepts assume the market to work within clearly framework conditions according to calculable dynamics (that can be modelled). The government is assumed to be almost almighty as long as the ‘political will’ is there. Economic instrument approaches often operate within the standard command-and-control framework (Davies and Mazurek 1998 cited in Cole and Grossman 1999: 892).

The objectives and dynamics of complexity, as well as causes and effects of the problem are perceived as manageable in both approaches, command-and-control as well as economic instruments. With traditional instruments like limits, commandments and prohibitions (in the case of command-and-control) or financial incentives (in the case of economic instruments) compliance and outcome are assumed to be controllable.

The main difference of economic instruments to the concept of command-and-control is given by a lower predictability of the behavioural changes of addressees. Within their distinct determined guidance of demeanour (Jänicke et al. 1999: 100; Michaelis 1996: 28), even the classical economic instruments allow a consideration of alternatives by those whose behaviour is to be modified and thus rely on decentralised decision-making and market mechanisms (James 1997: 11; Rubik et al. 2000: 46). For example, an actor can refuse the compliance to an economic instrument and accept material disadvantages, just because the costs of a behavioural change might be higher than the financial disadvantages. As economic instruments are in this context more voluntary and give the possibility of behavioural choice their guaranteed enforceability is more restricted. (While command-and-control demands specified behaviour (usually the application of technology), economic instruments allow the market to decide how and to what extent the goals will be achieved. This can be seen as a system of command, but with less control⁷

In conclusion both steering approaches assume defined objectives. Both approaches assume sufficient knowledge on systemic interrelations, so that cause and effect are transparent and the effect of steering intervention can be predicted. Problem solution can thus be managed by direct (command) and indirect (market) regulation of behaviour. Nevertheless the approach of economic instruments acknowledges some uncertainties in determining optimal allocation.

3.2 Steering as a problem of goals: Providing vision

The second cluster of theories focuses on setting goals for public policy and administration and establishing guiding visions for heterogeneous actors. By doing so, these approaches hope to overcome difficulties with the implementation of programmes and the coordination of diverse actors in society. They argue that steering actors can better and more efficiently use their capacities, if they provided clear goals or moderated vision building processes rather than prescribing particular ways of behaviour.

Two strands in this cluster of theories can be distinguished: One set of approaches, including *new public management* or *management by objectives*, aims at improving the performance of steering actors by pragmatically concentrating on the development and enforcement of performance goals. Another set of approaches is more sceptical about the possibilities to set goals in a top-down manner. They suggest the initiation and moderation of participatory proc-

⁷ Cole and Grossman 1999 even state economic instruments like tradable permissions as measures of “command-without-control” (p. 895)

esses for the development of shared *guiding visions* (“Leitbilder”) for regional development, organisational development, or technology development.

Approaches like *new public management* or *management by objectives* are inspired by concepts from business management which were transferred to public administration and government. This managerial perspective has dominated the reform of public administration in some countries in the 1980s and 1990s (Naschold and Bogumil 1998). The focus of steering is shifted away from detailed prescriptions of behaviour through instruments and measures towards the performance of a social system like a branch of administration, a sector, or a nation state as a whole. Clearly defined goals and performance indicators are used to provide guidance for the operation of social systems and for assessing outcomes. The system itself is free to choose appropriate measures to reach the goals. For example, in environmental policy the definition of goals has been declared a crucial element for steering, because, if consensually formulated, it facilitates implementation and facilitates monitoring (Jänicke et al. 1999). A good example for such a strategic approach are national environmental action plans (Jänicke et al. 1997).

Yet, there are approaches that emphasise the importance of goals, but are more sceptical about the possibilities of reaching consensus and the coordinating effect of authoritatively imposed goals. They recommend the organisation of participatory planning processes in order to generate shared visions among actors who are important for steering system development. For example urban or regional planning is exposed to various, partially conflicting demands from different actors, political levels and laws, from economy and environment etc. Against this background, shared or jointly developed visions can provide a) orientation by outlining the main features and the kernel of the planning for all stakeholders, b) coordination of heterogeneous actors by bridging contradictions or inconsistencies of interests, and c) guidance by motivating the participants and stabilising and focussing the planning process (Cools et al. 2003; Kuder 2004).

Visions developed in public discourse can have similar functions for the development and application of technologies (Canzler and Dierkes 2000). Similar to planning processes, guiding visions represent perceptions about technologies and their use in daily life which direct and coordinate behaviour in different domains of society. A public discussion about visions of technologies can be a way to make the underlying valuations explicit, to formulate alternatives, to formulate recommendations, and to communicate them via mass media.

In this perspective, the central problem for sustainable development is the lack of a shared vision. Considering the restrictions of steering actors to directly regulate behaviour of other agents, the best way to foster sustainable development are guiding vision which can coordinate action and behaviour in all spheres of a differentiated and fragmented society. Thus, it is necessary to call into question existing internalised visions, discuss their lacking compatibility with sustainable development and instead work towards visions that are based on integrated and long-term oriented assessments of alternative paths of development (Brand, Fürst 2002; Grin, Grunwald 2000).

3.3 Steering as a knowledge problem: Learning Approaches

Theoretical approaches in this third cluster mainly address the problem of complex and uncertain dynamics of the sustainability problem (dimension 2) and propose different ways of how to deal with it, while also differing in how they attend to the remaining two steering dimensions⁸. Very roughly put, incrementalist approaches focus on learning by small, unsystematic

⁸ Their generic steering type is thus characterised as ‘x - 1 - x’.

changes and mutual adaptation of actors; adaptive management stresses systematic policy experiments to cope with complex and changing environments, whereas network governance builds on incorporating knowledge of different actors in networks and on their potential for self-organised, collective learning.

Remarkably early and in the heyday of rational planning euphorism in the late 1950s, the political scientist Lindblom developed his approach of *disjointed incrementalism* and the science of “muddling through” (Lindblom 1959) and carried this further into the 1990s (Lindblom 1979; Lindblom and Woodhouse 1993). It explains why rational planning so often fails, but why and how policy making in the face of fundamental uncertainties can still be possible/successful. Given conflicting societal goals and values which prohibit a true consensus, incremental politics is suggested to policy makers, for it “reduces the stakes in each political controversy, thus encouraging losers to beat their losses without disrupting the political system.” (Lindblom 1979: 520). Even more important, incremental politics is considered and proposed to cope with uncertain causal dynamics as it is “intelligently exploratory when linked with sequences of trial and error” (ibid.). In order to learn effectively, “feedback from policy trials needs to rapidly reach those with authority to make a change. Feedback often takes too long, allowing accumulation of unfortunate results” (Lindblom, Woodhouse 1993: 133). As a central contribution of interest groups to policy making, partisan analysis “is the most characteristic analytical input into politics and also the most productive” (Lindblom 1979: 520). The process of policy making is conceived as “partisan mutual adjustment” which “takes the form of fragmented or greatly decentralized political decision making in which the various somewhat autonomous participants mutually affect one another” (Lindblom 1979: 523).

Different from most of the discussed steering approaches, the idea of *adaptive management* has been developed from eco-system management in the late 1970s (Holling 1980; Walters 1986), responding to the lack of understanding the management of complex systems (Lee 1999: 3). It acknowledges that “managed resources will always change as a result of human intervention, that surprises are inevitable, and that new uncertainties will emerge” (Gunderson 1999). Adaptive management stresses the need for a holistic understanding of nature and an integrated view of environmental problems, drawing on the concept of ecological resilience (Holling 1973, Holling and Meffe 1996) which expresses “the capacity of a social-ecological system to cope with surprise, unpredictability and complexity” (Pagan and Crase 2004: 6). A key strategy is to implement policies as systematic experiments whose outcomes are monitored and analysed in a scientifically-like manner in order to detect unanticipated and undesired side-effects (Freedman et al. 2002). The so gained knowledge feeds back into the policy system (“learning while doing”, Lee 1999). Instead of aiming to maintain a fixed (‘optimal’) state of an (eco-) system, different and even unexpected outcomes are viewed as acceptable so long as catastrophes and irreversible negative effects are avoided (Johnson 1999). The adaptive management approach has been used in several cases all over the world (Lee 1995; Lee and Lawrence 1986; Gunderson et al. 1995; Holling 1978; Röling and Wagemakers 1998). While many of these deal with the involvement of different interest groups, most of the schemes were implemented and led by a centralized decision maker, mainly the government (Lee 1995), hence the distribution of intervention capacities was very low.

Despite their different origins, disjointed incrementalism and adaptive management have much in common, both acknowledging the inadequacy of straightforward planning and implementation in the face of highly complex and dynamic natural and social environments where targeted influence on systems states fails due to a lack of knowledge regarding system dynamics. One main difference is the actor perspective, with adaptive management assuming basically a central steering actor and incrementalism considering multiple actors each pursu-

ing their own (sustainability) goals. The other main difference lies in the fact that while adaptive management strongly builds on the knowledge gained by systematic and iterative learning and its potential for better future management efforts, incrementalism remains more sceptical towards steering. Denying the possibility for thorough learning and systems understanding, incrementalism rather stresses quick feedback, learning, avoiding serious errors and flexibly coping with changing environments. To this end, small, manageable interventions are proposed that can easily be undone and that allow to quickly change their direction.

As a third approach to cope with uncertain causal dynamics, *network governance* is an emerging, not yet consolidated concept. Having its roots mainly in the economic (Jones et al. 1997; Sydow and Windeler 2000) and policy networks literatures (Kenis and Schneider 1991; Mayntz 1993; Scharpf 1997; O'Toole Jr. et al. 1999; Haas 2004; Sørensen and Torfing 2005), network governance is increasingly proposed to cope with sustainability problems (Dedeurwaerdere 2005; Siebenhüner and Suplie 2005). It acknowledges the “increasing importance of NGOs, the private sector, scientific networks and international institutions in the performance of various functions of governance” (Dedeurwaerdere 2005: 2). Assuming given sustainability goals, (policy) networks can be created, encouraged or maintained by a central steering actor (such as the state), which either directly takes part in a network or supervises/steers it from outside. Three different, but interrelated, lines of reasoning why and how this approach helps to deal with uncertain causal dynamics can be identified. From an (economic) transaction cost approach, networks are viewed as an intermediate governance form between hierarchies and markets, which allows actors to flexibly react to complex, uncertain and changing environmental conditions while being more stable and reliable than pure markets. Second, the creation of networks allows to integrate the different sources of knowledge and competences provided by the different actors, especially when the network structure fosters efficient information sharing and social learning (Cross et al. 2004). Third, from a more abstract complexity theory perspective, networks as “dissipative structures”, between markets and hierarchies, “at the edge of chaos” are expected to produce emergent and more creative solutions as compared to other forms of governance (Kappelhoff 1999).⁹

3.4 Steering as a power problem: Coordinating actors and networks

Theoretical approaches in the fourth cluster are mainly concerned with collaborative steering and how some new forms of collaborative policy making, negotiation and network management are filling the gaps that are left as central control capacities within society and organisations vanish. These collaborative processes, engaging players from different public sectors (e.g. inter-ministry working groups), from the public and private sector (e.g. neo-corporatist systems between governments and interest groups) or from different private sectors (e.g. collective bargaining between an employer and a group of employees) representing multiple interests, have become part of an emerging debate on governance and steering addressing the problem of distributed power across a multitude of actors and social networks as a restriction to unilateral steering by government departments or corporate management.

Beginning in the 1970s, both political science and planning studies have been observing a shift from the top-down, hierarchical model of policy making and planning to new forms of cooperative, self-organizing, inclusive modes of governance. In Western Europe, the crucial experience that triggered the movement from a more interventionist state, hierarchical control and rational planning to more cooperative forms of policy-making was the failure of ambitious reform policies that had been pursued since the 1960's (Mayntz 1996). Increasingly, the

⁹ Bringing different actors together in networks can also serve other purposes such as to enable effective bargaining. This will be elaborated in the following sub-sections.

institutional capacity for the implementation of program measures has been regarded to be not in the responsibility of parliament, government and administration alone. Instead, also companies, associations, unions and other NGO's considerably shape and give direction to the processes of policy making and implementation. It is stated, that the steering capacity of the modern state and the guarantee of the public interest depends more and more on implementation resources of various public and private actors having autonomous regulatory and decision competencies. Cooperative arrangements between public and private actors in policy making are regarded to activate and better exploit the private potential for self-regulation in order to reduce interventionist and hierarchical regulation to a minimum.

Very roughly put, collaborative policy making, network management and negotiation are processes whereby public or private agencies craft a solution or a program to a policy issue using dialogue, cooperation and/or bargaining with diverse public or private actors or policy networks being affected by the solution/program, and being able to implement (or to obstruct) it. This cooperation and interaction in public policy making takes place in different forms and the term collaborative policy making or cooperative governance is not precisely defined but covers different forms of coordination and interaction of public and private actors. Within this debate much scientific attention has been given to the direct collaboration of public authorities and private corporate actors in policy development: Theoretical perspectives on how dialogue, cooperation and dialectical processes can contribute to rational problem-solving (Habermas 1983; Dryzek 1990; 2000) together with the diagnosis of new problems of political steering provided the basis for the discourse on cooperative governance. The debate on cooperative governance and planning highlights the role of procedural norms providing voice opportunities to various stakeholders, promoting a communicative rationality and enabling for arguing and fair and equitable modes of problem-solving (Healey 1997, 1998; Bryson and Crosby 1992; Innes 2003). Unlike this, the scientific debate on *negotiation* focuses more on efficient decision making procedures by bargaining (for a detailed differentiation of arguing and bargaining cf. Saretzki 1996). The interest in the investigation of negotiation theories has expanded from its traditional domain of labour-management relation, to other areas of analysis such as natural resources. It focuses on situations in which the power to solve a problem is distributed across at least two agents and the decision makers could mutually benefit from reaching an agreement, but have conflicting interests over which agreement to conclude, i.e. how to cooperate. Negotiation theory seeks to identify the factors which determine the outcome of negotiations, bargaining power and power relations and the strategies that may sustain cooperation. For example both negotiators can improve their outcome by conceding on a low-priority issue in exchange for their most preferred outcome on a high-priority issue (so called "logrolling", cf. Froman and Cohen, 1970) or by linking different issues to provide for an enlarged bargaining set (cf. Bennet et al. 1998). On the basis of the extensive and heterogeneous debate on collaborative planning and negotiation, there exists extensive literature on methods and procedures of collaborative policy making like on *mediation and facilitation* (Bush and Folger 1994), on *dialogue* (Isaacs 1999; Yankelovich 1999), or on *participatory technology assessment* (Joss and Bellucci 2003; Durant 1999) which in many cases combines elements of both approaches. However, in many cases these approaches do not stress the point of distributed power alone, but also conflicting interests which can be mediated by specific forms of arguing and bargaining.

Especially organization and network theory have focused more thoroughly on the problems of distributed power across a multitude of organizations or networks and of interdependencies between them. Because policy making and the provision of many public services involve multiple actor groups and complex delivery systems which are far beyond the ability of the state or any single private organization, the relevance of *inter-organizational coordination* was highlighted in organization theory (Alexander 1995, Chisholm 1989). Closely connected with

this debate, *policy networks* of public and private actors, in which the state and civil society are loosely coupled, have been theorized since the 1990's (Marin and Mayntz 1991; Rhodes/Marsh 1992; Börzel 1998). Such Policy networks can be understood as (more or less) stable patterns of social relations between interdependent actors, which take shape around policy problems and/or policy programmes (Kickert, Klijn and Koppenjan 1997: 6). Interlinked with that debate studies on *innovation networks* emphasized that in many cases neither single inventors, innovative entrepreneurs nor public R&D institutions have the power to generate innovation by their own. Instead, continuous interaction between a growing number of heterogeneous policy makers, regulators, scientists, developers, business companies and consumers is now seen as one of the main preconditions for successful innovation processes. Increasingly, innovation has become a network activity (Rammert 1997; Smits and Kuhlmann 2004). Thus, public policy as well as socio-technological innovation are made and implemented in networks of interdependent actors which can both, obstruct and sustain policy implementation. In this perspective, the central problem to foster sustainable development is to coordinate interdependent actor groups and manage complex networks in order to enhance policy performance, innovation and public service delivery (Kickert, Klijn and Koppenjan 1997). Public management should therefore be seen as network management, and distributed control and interdependency are the key words in the network approach.

3.5 Steering reflexive co-evolution: Modulating self-organisation

A last cluster of theories can be characterised by their radical parting with an understanding of steering that has to do with anything like goal oriented control. Instead, they view governance of sustainable development as a task of modulating open-ended developments which are driven by a complex interplay of the inner dynamics of actors, subsystems, and bio-physical processes. The theoretical background is formed by concepts such as self-organisation¹⁰, complexity¹¹, or co-evolution¹². In this view development is contingent and future structures are emergent phenomena that cannot be influenced by single factors (like a strategy of a particular actor) but that come into existence only in the relation and interaction of many diverse factors. This also resolves problems of steering. If a particular path of development is left to emerge from interaction, goals need not be defined, problem definitions not provided, and strategies not enforced. It is left up to the process to come up with sustainable development without the need for defining it, *ex ante*. Nevertheless, even on this yielding theoretical ground it is acknowledged that development cannot be left entirely to its own, but must be shaped for sustainability. Proposed strategies aim at a certain quality of the emergent result by shaping the interaction processes from which they emerge, while they concede that the particular result of self-organisation cannot be predicted or controlled¹³. The question is: how can self-organisation be modulated as to bring about development that qualifies as sustainable? We briefly discuss transition management and decentralised context steering as two theoretical streams of thinking in this orientation.

The concept of *transition management* emerged from a policy history to develop environmentally friendly technologies in the Netherlands (Kemp and Loorbach 2003). It reflects theoretical development in understanding socio-technical change as a multi-level, co-evolutionary

¹⁰ (Weick 1977; Küppers 1994; Mayntz, Schneider 1995; Kauffman 1995; Hinterberger 1996; Küppers 1999; Müller-Benedict 2000; Eder 2002)

¹¹ (La Porte 1975; Waldrop 1992; O'Connor 1994; Jessop 1997; Byrne 1998; Kappelhoff 2000) Urry 2005

¹² (Mulder et al. 1999; Hughes 1987; Anderson et al. 1988; Burns, Dietz 1992; Norgaard 1994; Hinterberger 1994; March 1994; Nelson 1994; Tushman, Rosenkopf 1994; Burns, Dietz 1995; Schneider, Werle 1998; Nelson 2000; Rip 2002; Rip, Groen 2002; Voß 2006)

¹³ For general accounts see (Dobuzinskis 1992; Rip 1998; Axelrod, Cohen 2000; Rip 2006)

process (Rip, Kemp 1998; Geels 2002; Berkhout et al. 2004). It is presented as “a deliberate attempt to bring about structural change in a stepwise manner. It does not attempt to achieve a particular transition goal at all cost but tries to utilise existing dynamics and orient these dynamics to transition goals that are chosen by society. The goals and policies to further the goals are not set into stone but constantly assessed and periodically adjusted in development rounds” (Kemp and Rotmans 2001). The concept contains particular methodical elements to deal with steering problems in all three dimensions.¹⁴

The approach aims at increasing procedural capacities for societal learning what sustainable development is and can be, rather than steering it into a specific direction. The general approach, despite its radical theoretical basis and openness within the process, however, is indeed quite managerial with respect to the set-up of the whole process. It is assumed that actors can agree on common visions of a sustainable future, that incremental experiments serve to learn about long-term system development, and that all important actors can be coordinated within the transition arena.

A more abstract theoretical idea is that of “*decentralised context steering*” (*Dezentrale Kontextsteuerung*) proposed by (Willke 1992: 189-192; 335-342; Willke 1999:232-242). It departs from a system functionalist understanding of societal development as driven by the differentiation of autonomous, functionally specialised subsystems (Luhmann 1987; Schimank 1988; Mayntz et al. 1988; Luhmann 1990; Schimank 1996). The dynamics of subsystems are based on self-organizing communicative processes which are independent of their environment. Societal development is not controlled from anywhere, neither from the inside, nor from the outside of any of the systems. Our three steering problems all fall in one: communicative differentiation implies diverging goals, problem perceptions and detached sources of influence. It is argued, however, that there is a need to shape societal development in order to avoid the self-undermining effect of “externalities” caused by autonomous system operations. The key is to make use of the adaptive capacity of systems. Confronting the systems with the effects of their own activity can make them reinterpret a situation and come up with a different behaviour. The interpretation of what must be done and how behaviour must change is left up to the self-steering of systems. What can be done is only to influence the context conditions in which their autonomous dynamics unfold. This leads to a steering theory for sustainable development that applies to the intensification of feedback between systems in order to bring about a more closely coupled development that causes less harmful externalities. Practically, this comes down to the creation of interface arrangements in which mutual interference can be discerned and processed. The state (political system) is assigned a special role as a moderator and supervisor for these decentral context adaptations.

The general line of thinking that is implied in transition management as well as in decentral context steering is an understanding of fundamental limits to steering due to the emergent dynamics in complex systems, such as society. Both approaches emphasise the relevance of

¹⁴ One is the collective creation of a vision of future socio-technical system structures in which diverse social goals are brought together. Another element is a sophisticated learning approach to deal with knowledge problems: A variety of different development paths is identified via backcasting from the sustainability vision. Then, experiments are devised to explore each of these different paths. Regularly evaluation leads to conclusions about actual feasibility and desirability of development paths and the vision that they shall lead up to. These conclusions then form part of the knowledge base for the next round of envisioning and experimenting (for similar approaches of recursive envisioning and experimenting see "directed incrementalism" proposed by Grunwald 2000; and "adaptive planning" as conceptualized by Weber 2006). The problem of distributed power is addressed in transition management by organising a constituency which involves heterogeneous actors with diverse sources of influence on socio-technological development. “Transition arenas” are initiated and moderated in order to carry out the strategy process as described above and coordinate distributed experimentation activities.

bringing different social unities, be it actors or subsystems, in interaction with each other. This is to allow for mutual adaptation and alignment and avoids adverse effects of uncoordinated development.¹⁵ Other approaches for the governance of sustainable development have been developed on a similar theoretical basis, partly with reference to both approaches discussed above. They combine the unpresuming approach of decentral context steering (e.g. with respect to the possibility to reach agreement on common visions of sustainable development) with the effort to propose detailed procedural provisions, like those exemplified by transition management (Voß et al. 2006).

4 Relating theories to steering contexts

The preceding overview contains a collection of theories which frame and define steering problems in fundamentally different ways – even though there are junctions and areas of overlap. From our overview, however, we can see that an important difference between steering theories is where they dig up fundamental problems of steering, explicitly discuss them and propose strategies to handle them – or where they make an implicit or explicit assumption that there are no fundamental problems with respect to the definition of goals, knowledge about dynamics, or power to take influence.

The typology of steering situations together with the review of steering theories according to their assumptions about critical characteristics of steering situations allows us to present, in quintessence, an approach of how to match adequate steering theory with a given situation. Criteria for ambivalence of goals, uncertainty of knowledge, and distribution of power can be used to identify the type of steering situation that is given. According to each type there is a specific set of theories that is appropriate, because its assumptions correspond to the situation. Table 2 summarises this matching of theories to specific steering situations. A light circle indicates that an approach deals with the respective steering dimension and proposes strategies to cope with or reduce this complexity. A full circle indicates that this approach is particularly suitable for dealing with the respective steering dimension.

	Command & Control	Economic Instruments	Leitbild-steuerung	Adaptive Management	Disjointed Incrementalism	Network Governance	Cooperative Governance	Transition Management	Dezentrale Kontext-steuerung
ambivalence of sustainability goals			●		○		○	●	●
uncertainty of knowledge about system dynamics		○		●	●	●		●	●
distribution of power to shape development		○			○	○	●	●	●

Table 2: Which kind of theory helps for which kind of steering problem?

¹⁵ Compare (Lindblom 1969) on this aspect. Also in network theories of socio-technical change, interaction and alignment play a central role in shaping emerging socio-technological configurations (Callon 1986; Callon 1987; Law, Callon 2000 [1992]). Along these lines Nexus Arrangements (van den Belt, Rip 1987) and Socio-Technical Scenarios (Elzen et al. 2004) are proposed as steering approaches.

Oftentimes, however, it is not only one theory that matches a situation. The overview also makes it possible to combine elements from different theories. It shows that there are alternative proposals of how to deal with ambivalent goals or uncertainty, for example. On the basis of a classification of steering situation, steering approaches can be pragmatically, and still insightfully, combined.

Cluster	Theory / Approach	Assumptions about ambivalence / <u>decidedness</u> of goals	Assumptions about uncertainty / predictability of dynamics	Assumptions about distribution / concentration of influence
1 Steering through regulation: Crafting rules	Command & Control 0 - 0 - 0	<u>Assumption:</u> 0	<u>Assumption:</u> 0	<u>Assumption:</u> 0
	Economic Instruments 0 - ½ - ½	<u>Assumption:</u> 0	<u>Assumption:</u> 0,5 <u>Solution:</u> 0,5 build on local knowledge of the addressees to tackle problem	<u>Assumption:</u> 0,5 (heterogeneous addressees) <u>Solution:</u> 0,5 set incentives, no direct control of actors
2 Steering as a problem of goals: Providing guidance	Leitbildsteuerung 1 - 0 - 0	<u>Assumption:</u> 1 <u>Solution:</u> 0 (shared visions)	<u>Assumption:</u> 0	<u>Assumption:</u> 0
3 Steering as a knowledge problem: Learning Approaches	Adaptive Management 0 - 1 - 0	<u>Assumption:</u> 0	<u>Assumption:</u> 1 <u>Solution:</u> 0,5 learning while doing by policy experiments and systematic feedback (monitoring)	<u>Assumption:</u> 0
	Disjointed Incrementalism 1 - 1 - 1	<u>Assumption:</u> 1 <u>Solution:</u> 0,75 actor can realize her goals independent of others, they have to compromise and adapt	<u>Assumption:</u> 1 <u>Solutions:</u> 0,5 - partisan analysis to reduce complexity - small changes in order to be ready to alter policy - learning while doing by policy experiments and systematic feedback	<u>Assumption:</u> 1 <u>Solution:</u> 0,75 (interplay of actions shapes policy development, mutual adjustment of strategies in policy processes)
	Network Governance 0 - 1 - ½	<u>Assumption:</u> 0	<u>Assumption:</u> 1 <u>Solution:</u> 0,5 incorporation of different sources of knowledge and competence, synergy	<u>Assumption:</u> 0,5 <u>Solution:</u> 0,5 (active steering of network by central actor)
4 Steering as a power problem: Coordinating actors and networks	Cooperative Governance 1 - 0 - 1	<u>Assumption:</u> 1 <u>Solution:</u> 0 establish compromise/ consensus through mediated processes	<u>Assumption:</u> 0	<u>Assumption:</u> 1 <u>Solution:</u> 0 cooperation and effective procedures for conflict resolution
5 Steering as reflexive co-evolution: Modulating self-organisation	Transition Management ½ - 1 - 1	<u>Assumption:</u> 0,5 <u>Solution:</u> 0 shared visions	<u>Assumption:</u> 1 <u>Solution:</u> try out diverse options as experiments	<u>Assumption:</u> 1 <u>Solution:</u> build on self-organization, diffusion, amplification
	Dezentrale Kontextsteuerung 1 - 1 - 1	<u>Assumption:</u> 1 (subsystems each have own "rationality") <u>Solution:</u> 0,75 (adaptation of own goal with respect to societal change)	<u>Assumption:</u> 1 generally, dynamics considered complex, no systems knows all <u>Solution:</u> 0,75 coupled, but autonomous self-steering within each social subsystem	<u>Assumption:</u> 1 (autonomous systems) <u>Solution:</u> 0,5 (supervisory state confronts systems with their contexts and makes them reflect their decisions in light of interactions with system environment)

Table 3: Assumptions of steering theories with regard to ambivalence, uncertainty and distributed power

Since the characterisation of steering contexts is largely dependent on how problems are defined the systematic discussion of strategic consequences that follow from assumptions about goals, knowledge and power to take influence also allows for reflecting the ‘hidden aspects’ that are linked to pragmatic reductions. It can therefore be helpful in addressing particular aspects of sustainable development problems in sequence, depending on available capacities.

A more detailed overview is provided by Table 3 which groups all theoretical approaches in the respective clusters. The “generic steering types”, e.g. 0-1-0, indicate the assumptions theories make regarding the complexity of the three steering dimensions. Where an approach aims at reducing this complexity, this is indicated as “solutions”. For instance, the Adaptive Management approach assumes low ambivalence of goals (“0”), high uncertainty of dynamics (“1”) and low distribution of influence, and proposes strategies to deal with and reduce uncertainty of dynamics (solution: “0,5”).

Analysing the different theoretical steering approaches reveals a number of “basic strategies” which are proposed to deal with complex steering situations. Some of them appear in several approaches, others are unique to one specific approach. Table 4 presents those strategies. Some of the strategies aim to reduce the ambivalence, uncertainty, or distribution, while others merely aim to map out the complexity in order to better deal with them. Strategies of the first kind are mentioned at the top, those of the latter kind, at the bottom. The more a strategy involves ways to reduce complexity, the more it is displayed at the bottom. Take the example of ambivalence of goals. While mapping diversity (1.) does not reduce ambivalence, a policy decision, e.g. by majority vote (2.), does reduce ambivalence at least for the scope of the decision. However, different actors may still hold different views on which goals to pursue. The next step would be to reach a compromise (3.), or, better yet, a consensus (4.) which means different views on goals have converged. Shared visions (5.), finally, indicate the “deepest” consensus and thus the most lasting strategy to actually reduce ambivalence of goals.

Strategies to cope with <u>ambivalence</u> of goals	Strategies to cope with <u>uncertainty</u> of dynamics	Strategies to cope with <u>distribution</u> of influence
<ol style="list-style-type: none"> 1. map diversity of goals 2. policy decision (majority vote etc.) 3. compromise by mutual adaptation 4. compromise/consensus through mediation 5. build shared visions (through deliberation, social learning) 	<ol style="list-style-type: none"> 1. scenarios to explore possibilities 2. small changes for flexible policy change 3. policy experiments and systematic feedback (monitoring) 4. partisan analysis to reduce complexity 5. include different (local) competences in actor groups / networks 6. synergy, emergent behaviour, self-steering 	<ol style="list-style-type: none"> 1. indirect steering via context settings, e.g. by (economic) incentives 2. bargaining 3. arguing 4. mutual reflexive adjustment of strategies in interaction

Table 4: Strategies to cope with ambivalence, uncertainty, and distributed power

5 Conclusions

Concluding this paper, we would like to take stock of what our discussion has yielded in terms of new insights into steering for sustainable development.

The conceptualisation of goals, knowledge, and power as three fundamental ‘ingredients’ for steering, together with criteria to assess different degrees of complexity that they can portray in particular steering contexts, allowed us to sketch a typology of steering contexts. This ty-

pology systematically portrays situations within which steering for sustainable development is confronted with different kinds of difficulties – from skilful crafting of regulatory arrangements to disorientation, ignorance and powerlessness.

Differentiating degrees of complexity in goals, knowledge, and power also offered a novel way of looking at steering theories. Theories could be differentiated according to the assumptions they make about steering contexts. Do they assume the existence of unequivocally defined goals, certain knowledge and centralised power? Or do they deal with situations in which goals are ambivalent, knowledge highly uncertain or where power is distributed? We found that theories can be grouped in clusters according to what they assume and where they explicitly problematise goals, knowledge and power. From this we could derive an overview on steering theories which can help to sort out theories that match the conditions given in any particular steering context. The overview also provides a collection of alternative strategic approaches that are offered from different theoretical perspectives in order to deal with steering problems in the dimension of goals, knowledge, or power.

We believe that the differentiated perspective on steering contexts and theories which we have worked out in this paper can overcome stalemate in theoretical debates about the possibility or impossibility of steering. Instead it furthers constructive assessment of complementarity between different theories and strategic recommendations. In terms of practical steering for sustainable development the portrayed approach thus supports capacity development. It provides a way to systematically consider what is on offer in academic debate and allows finding conceptual frameworks and strategic implications for the particular empirical context in which steering actors find themselves.

Also with respect to the general question that was raised in the introduction - if the fundamental changes implied by sustainable development have any chance to be realised at all – we can formulate an answer on the basis of the preceding discussions. One aspect of the answer would be that the challenge of sustainable development comprises many distributed steering activities such as long term sectoral planning, regulating markets, international negotiation, municipal policy making, managing companies, reforming administrative agencies, mobilising social movements, establishing new approaches in science and education, shaping attitudes etc. These activities are embedded in different contexts and may address more or less complex topics. Not all steering situations for sustainable development are therefore characterised by high complexity that translates into ambivalent goals, uncertain knowledge and distributed power. Some steering situations, setting energy efficiency standards for equipment purchase of a company, for example, are quite simple. While others, like shaping long term structural change in electricity systems, are indeed very complex with respect to goals and knowledge as well as with respect to power. The overview shows that there are elaborated ideas for how to deal with steering problems in each of these situations. Some are more straightforward and promise higher chances of success. Others are more interactive and seek to provide procedures for open ended learning. Generally, however, there is no reason to refrain from experimenting with steering for sustainable development altogether. Nor does it seem necessary to achieve global consensus on detailed definitions of sustainable development in any area of concern, before strategic action can start. The overview shows different ways in which ambivalence of goals and uncertain knowledge can be taken up in procedural approaches towards steering.

Theoretical debate can profit from distinguishing problem dimensions of steering in order to match empirical contexts with appropriate theories, because it is a step towards specifying the range of theories. Practical steering can profit because it helps to choose a theoretical framework that addresses the particular problems that are prevalent in a given empirical context. We have to add a remark, however, with respect to the distinguished degrees of complexity in

empirical steering contexts. This is that the classification of steering contexts according to ambivalence of goals, uncertainty of knowledge, and distribution of power, and its position in the typology is largely a question of how a particular steering problem is defined by the actors who are involved. The complexity of a steering context can hardly be assessed objectively. It is importantly influenced by the individual perspectives of actors (and their willingness and resources to deal with higher levels of complexity). This refers to how narrow or broad they define the requirements for sustainability (e.g. environmental sustainability only, or including social aspects of sustainable development), where they draw system boundaries (e.g. include feedback and possible distanced and long-term effects or concentrate on confined linear models of cause and effect), and how aware they are of other actors who can interfere with their own strategies (e.g. taking into account the obstruction potential of addressees of regulation).

In the preceding discussion we referred to ‘empirical steering contexts’ as they are perceived by any particular steering actor. Any such framing, problem definition or analytical setting of system boundaries may become subject to debate as to how far it actually represents empirical reality. This dispute also involves the interests of actors (as, for example, when dominating actors propagate their view as a general consensus in order to generate legitimacy; see Mayntz 2004). The characterisation of a steering context with respect to ambivalence of goals, uncertainty of knowledge, and distribution of power is therefore also a political process.

This is why the presented typology will not be able to resolve social dispute over the appropriateness of steering approaches in any particular situation. It would rather shift the debate away from the level of steering theory onto the level of problem definition. Where some see clearly-defined goals, predictability and control over relevant factors, others see all kinds of complexities and uncertainties. We believe, however, that social debate about adequate problem definitions can be more fruitful for increasing societal capacities to cope with sustainable development than a confrontation of universal theoretical claims about the possibility of steering in which no reference to particular context conditions is made and assumptions with respect to goals, knowledge and power remain opaque. Our attempt at formulating criteria for each dimension, that allow to assess the degree of complexity with which one has to deal in finding appropriate steering strategies, is one step into the direction of making intersubjective discussion possible. Here, however, more elaborate approaches could follow.

Our overview on steering theories shows that there is already a lot on offer in terms of understanding steering problems and practical proposals how to deal with them. More research and development of practical capacities may be needed for making use of what is there. This includes possible ways to combine elements from different theories as well as concrete methods to implement steering strategies such as, for example, incrementalism and decentralised context steering. We hope this article will further constructive learning in this direction.

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