

## Environmental Politics – The Stocks Framework and the Art of Long-Term Thinking

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### Abstract

In ancient philosophy, practice existed only to create space for the wise to contemplate theory. In the ideal of modern science, however, science is an abstract system of cognition, providing the basis for technological control of nature.

The stocks framework is an attempt to overcome the gap between theory and practice, between academics and practitioners. In contrast to Mainstream Economics, Ecological Economics emphasizes the role of time in politics by examining the dynamics of economic, social and environmental stocks and their relationships. Stocks may be material or immaterial, such as a social institution like legislation.

Our applied example examines the development of sustainable inland shipping policy in Germany. To this end, we proceed in seven steps, starting with the policy aims and relevant facts known about German inland shipping. This enables us to identify the relevant material and immaterial stocks associated and their dynamics. In doing so we can summarise the normative demands placed on German inland shipping policy by the general principle of sustainability and formulate concrete goals. Finally, we propose concrete policy recommendations for the transportation system.

The last chapter describes the stocks framework as a school of long-term thinking. It shows how a practitioner is able to learn to deal with issues over long timescales.

We note that this concept is almost identical to chapters 12 and 13 of the book *Sustainability and the Art of Long-Term Thinking* by Klauer et al. 2017.

Related concepts: BASICS OF TIME; BASICS OF LIFE; SUSTAINABILITY & JUSTICE; HOMO OECOMICUS & HOMO POLITICUS; POWER OF JUDGEMENT; IGNORANCE

## 1. History

This concept of MINE differs from the others in that we explore not a concept but the question of action in environmental politics.

### Theory and practice in Ancient philosophy

“The ideal of pre-modern science is to contemplate the world. Theory (the ancient Greek word *theoria* means ‘sight’) wants to recognize its essence by its very nature. “Theory is an independent, self-sufficient way to access the world that is not subordinate to any purpose. It exists independently, alongside practice – the actions of humans according to their specific human aptitudes and the characteristics of the objects. In the thinking of Plato (428/427 – 348/347 B.C.) and Aristotle (384 – 322 B.C.), theory and practice are separate orders, but if there is a relationship between the two, then practice exists for the sake of theory: Practice should create a space for the wise to remain undisturbed. But the ideal of modern science is, in a certain sense, divided into two parts: One part is science as an abstract system of cognitions, the other part is science serving as the basis of the technological control of nature.

The idea of science as an abstract system of knowledge has supplanted the ancient *theoria*, insofar as it is developed value-free and for its own sake. In an abstract system of knowledge, the dissolution of all objects takes place down to the last indivisible parts and mathematical laws that govern the movements of these elements. However, the abstract system can often be used to develop techniques that make the knowledge it holds useful for mastering the objects in practice. In many cases, even the mastery of real processes requires the development of an abstract system of knowledge to ensure the comprehensive and long-term exercise of this mastery. This has shifted our view of the nature of science to a second part. Real knowledge is increasingly measured by whether it can prove its truth in successful application. Accordingly, the ancient ideal of the sage distanced from the world and at the same time submerged in his essence is replaced by the ideal of the man of action (Binswanger 1985; Faber and Manstetten 2013: Chapter 7), the inventor, engineer, manager, and entrepreneur, etc. According to this world view, the ideal of the abstract thinker, unrealistic inventor and hobbyist still exists but is clearly subordinate to the man of action.

### The natural sciences replace ancient and medieval traditions

Statements by Francis Bacon (1561 – 1626) demonstrate our traditional view of the world and man being replaced by a new one. At the beginning of the 17th century, he sharply criticized the science of his time which was based on a world interpreted through Aristotelian and scholastic ideas:

‘Credulity..., aversion to doubt, indiscretion in answering, bragging about education, shyness of contradiction, interest, casualness in one’s own research, word fetishism, standing still at mere partial knowledge: This and the like has prevented the happy marriage of the human mind with the nature of things and, instead, he is tied to vain concepts and haphazard experiments: The fruit and offspring of such a glorious union can easily be imagined’ (Bacon, quoted in Horkheimer/Adorno 1971: 7; our translation).

A spirit of optimism expresses itself in Bacon’s utterances, as is characteristic of the emergence of modern science. In contrast to rigid school knowledge, there is a sense of the right to doubt, the right to scrutinize, but at the same time an unwillingness to stop halfway in research. It is all about modesty and prudence in assessing the results.

However, it is doubtful whether the ‘marriage’ between Bacon’s ‘nature of things’ and the ‘human mind’ can really be ‘happy’ for both parties: The ‘nature of things’ is the dependent, potentially oppressed partner, while the cognitive faculty of man is its superior. This superiority has two significant aspects.

The first aspect is that of the ‘nature of things’, only those moments are left which human cognition can absorb: They do not get caught up in a web of questions, they remain unconsidered. In the sense of Bacon, this aspect was perhaps best expressed by Kant in the Critique of Pure Reason:

‘Reason must approach nature holding in one hand its principles, according to which only concurring phenomena count as laws, and in the other hand the experiment that reason conceived based on these principles, with the aim to be taught by nature, but not in the manner of a pupil parroting whatever the teacher wants, but instead like an appointed judge who compels witnesses to answer the questions he puts to them’ (Kant 1787/1977: 23; our translation).

The second aspect concerns the practice that accompanies this approach to gaining knowledge: The possibility of recognising certain relationships in nature leads to an overall growing, albeit partial, control of the forces of nature. The good fortune of Bacon’s vaunted marriage of nature and reason hence is reserved for the latter which merely sees nature as a means for achieving the loftiest goals of humanity: “The human race’s power and domination over the whole of nature’ (Bacon quoted after Meyer-Abich 1986: 136) is man’s

highest ambition. The word ‘domination’ denotes a central problem of modern science” (This paragraph has been translated from Faber and Manstetten 2014: 55-57.).

#### Environmental policy: the Stocks framework

Mapping the Interplay between Nature and the Economy (MINE) takes an interdisciplinary approach, incorporating the aspect of time [see concepts BASICS OF TIME; THERMODYNAMICS; IRREVERSIBILITY; EVOLUTION; SUSTAINABILITY & JUSTICE]. Using the stocks framework allows us to describe a problem in such a way that non-specialists can understand the dynamics of it and thus its environmental and economic impacts.

The term ‘stock’ as introduced to the Ecological Economics debate by Georgescu-Roegen (1971), his purpose being to steer the debate among economists regarding the concept of capital in a new direction. “His concern was to place greater emphasis on the real or material aspect of what was known as capital, which seemed to him at the time to be largely hidden by a value-based, technical concept of financial capital. Georgescu-Roegen contrasts ‘stock’ with ‘flow’ – a change in stock. The conceptual pairing of stock and flow was intended to address the structures of change over time independently of market value or exchange value.

During the 1980s and 1990s both the concept of capital and – less conspicuously – the conceptual pairing of stock and flow, used as a means to study intertemporal decisions in economic systems, were introduced into the debate around sustainability [SUSTAINABILITY & JUSTICE]. These issues were studied prominently in the context of neo-Austrian capital theory (Faber 1986: Chapter 3, Faber and Proops 1998, Stephan 1996, Faber et al. 1999, Winkler 2003; see for a Mainstream Economics’ (neoclassical) perspective Bliss 1975, Burmeister 1980).

At certain points in this process these concepts were interpreted in new ways. Materials flows were a significant element in this, particularly in the debate about the closed substance cycle economy and life cycle assessments. At the same time, efforts were underway in ecology to understand ecosystems as networks of materials and energy flows, a subject taken up by ecological economists to generate information about their sustainability. The concept of stock developed in this concept takes its point of departure from this revised understanding of Georgescu-Roegen’s term. Unlike him, however, we are less concerned with distinguishing between stocks and flows than with observing long term dynamics by directing attention towards the long-term persistence and constancy (*Beständigkeit*) of things” (Klauer et al. 2017: 34). A first attempt to develop a general theory of stocks was made by Faber et al. (2005a, 2005b) and by Klauer et al. (2013, 2017).

## 2. Theory

We offer a framework to deal with political policy in general and sustainability policy in particular. First, we deal with the question as to how it is possible to overcome the gap between theory and practice between academics and practitioner (Section 2.1). We emphasize how important the role of time is in politics (Section 2.2). To consider time adequately, a stocks framework must be developed, as is done in Sections 2.3 to 2.4, which allows an understanding of ecological, economic and social interconnections. In Section 2.5 we demonstrate how the stocks framework can be applied to problems of sustainability.

### 2.1 Overcoming the gap between theory and practice

“The conflict between theory and practice often seems hopelessly entrenched, with academics bemoaning the lack of attention politicians pay to their research results and politicians complaining that academics contribute too little towards solving their problems. With the advance of interdisciplinary research and systems analysis, the two contrary positions have seen a degree of rapprochement, of course, but a fundamental and insurmountable chasm between academia and politics remains nonetheless. The authors of this concept [book in original] – economists, sociologists, political scientists, mathematicians, physicists and philosophers – make no attempt to overcome this opposition.

Rather, by accepting it as given, they use it as a springboard to highlight ways of dealing constructively with it. Their conceptual framework of stocks [BASICS OF LIFE; BASICS OF TIME and Section 2.2 below], which takes certain ideas from the economic theory of capital (Bliss 1975, Burmeister 1980, Stephan 1995, Faber et al. 1999), elaborates them further and has been tested in three case studies (Klauer et al. 2017), is evidence of the extent to which they have succeeded in doing so. It is no exaggeration to claim that it constitutes a new method in research-based policy advice. Within five minutes flat – the amount of time politicians grant academics for an initial advisory session – advisers can present a diagnosis, analysis and potential remedies for complex long-term problems. Although the method has been developed based on scholarly – especially philosophical – foundations it is not itself an academic discipline but rather an art: the art of long-term thinking.

This art is based on the conceptual framework of stocks, which has been elaborated during years of research and in environmental policy advising in Germany, USA and China.

Stocks are both material and immaterial in nature. In the former case they are things, such as machines, and in the latter institutions, such as habits and rules. By looking at stocks we can provide an initial description of the problem that is immediately and readily evident.

If fundamental changes are to be made to transportation, an overview of stocks in terms of roads, cars, motor vehicle companies, traffic regulations, transportation plans, transportation volume and typical behaviour in traffic makes it plain straight away that such changes can only be made over the long term and only with political will coupled with patience and determination. Stocks – in German *Bestände* – draw attention to the fact that a particular thing that exists – *das Bestehende* – is by nature long lasting and inert, in other words, that it displays persistence over time – *Beständigkeit* – regardless of whether or not we wish it to continue. When dealing with stocks, the key is to develop a ‘sense of time’ [BASICS OF TIME]. It is not only a matter of possessing patience and endurance, it is also a matter of recognising the right moment to act, much like Field Marshall Kutuzov in Tolstoy’s *War and Peace* (cf. Section 8.4 in Klauer et al. 2017 and BASICS OF TIME).

The conventional means of decision support provided by the disciplines of economics and politics are not up to the task, neither is rational choice theory or its successor theories. Making sound decisions requires more than just considering profits and costs determined on the basis of the present pricing system. It requires judgement refined by experience. In complex situations where decisions need to be taken and there is a lack of knowledge about many aspects of the potential options, the conceptual framework of stocks provides the decision makers with a set of guidelines for creating order and making sense of all the different disciplinary expert knowledge available. At the same time, judgement provides appropriate space for creativity, intuition and feeling without being overly dominant. The focus on ways of looking at stocks ensures that the openness available for decision making does not tip over into arbitrariness” (Faber 2017: XIX).

## 2.2 Time and policymaking: the stocks framework

### Time as the main theme

The topic of time “is seldom placed at the centre of scholarly study – perhaps precisely because it is so fundamental and ever present. In fact, the same is true even of sustainability research, where thinking in long-term time spans ought to be taken for granted. In academic studies, time is generally dealt with (if at all) as a secondary issue or as merely implicit. The topic has no prominent place in present day philosophy either. In this project, however, we have placed this topic firmly centre stage. Both as academics

and philosophers we are keen to explore ways of acquiring the ability to think in long timescales. We seek to provide knowledge that serves as an orientation for practical political action in situations where it is crucial to adopt a long-term perspective” (Klauer et al. 2017: xv). How prominent the theme time is in MINE can be seen from the fact that it appears directly or indirectly in the title of seven of fifteen concepts of MINE (BASICS OF TIME; THERMODYNAMICS; IRREVERSIBILITY; EVOLUTION; BASICS OF LIFE; SUSTAINABILITY & JUSTICE; ENVIRONMENTAL POLITICS).

Note that in BASICS OF LIFE: STOCKS, STORES AND FUNDS, time plays a dominant role, since “the concept of stock (Bestand) enables objects to be depicted in terms of their temporality, changeability, persistence and inertia” (Klauer et al. 2017: 177).

## 2.3 Perspectives: systems and stocks

We previously referred to the stocks framework in BASICS OF TIME (Chapter 2). We noted that “the stocks concept is embedded in a stocks framework consisting of the three key concepts of time, stock [BASICS OF LIFE] and judgement [POWER OF JUDGEMENT]. The stocks framework is designed to facilitate action that is guided by judgement and oriented towards achieving sustainability [SUSTAINABILITY & JUSTICE]. When use the method and the key concepts of the stocks framework to gain a comprehensive view of a specific sustainability problem, we say that they are adopting a stocks perspective – this is illustrated in chapter 3 below” (Klauer et al. 2017: 36).

“The core elements of the stocks framework, namely, the concepts of *time*, *stocks* and *judgement*, will be explained briefly in Section 2.4 below. First, though, we will consider an important distinction between two ways of looking at problems that are a combination of ecological, economic and social issues:

- the systems perspective, in which things are always regarded as being part of a system, and
- the stocks perspective, in which ecological/economic/social systems are perceived first and foremost as being a conglomeration of stocks.

### Systems perspective

Understanding nature, society and the economy, or their aspects, in terms of a system means not merely looking at things in isolation from one another but taking an interest in the particular way these things are interconnected with one another. An omniscient

individual wishing to devise policy action for sustainability would consider the interplay between all the interactions that occur in nature and society in order to reach the best of all possible decisions based on this knowledge. The notion of achieving a full and complete understanding of the world and acting on this basis seems to be the (unachievable) ideal of scientifically grounded policy making [IGNORANCE]. One could call such a depiction of the entirety of interrelationships and interactions an 'ecological/economic/social comprehensive system'.

Since such a comprehensive depiction is not possible, disciplines such as ecology, economics and sociology instead develop ways of representing those parts of this interconnected whole that are empirically available to each disciplinary perspective and can be described using their conceptual and methodological apparatus. Although interdisciplinary and transdisciplinary programmes exist for bringing the separate disciplinary systems together into a unitary overall picture, these programmes do not themselves constitute scientifically robust methods in the strict sense. Compiling an overall picture of a problem based on the results of isolated disciplinary studies is not itself the task of a scientific discipline (in the sense of developing a falsifiable theory); instead, such a task is already part of practical (scientific) policy and policy advice. This means that those involved in devising sustainability policy typically have access to systemic knowledge which, measured against the task of producing an overall picture, is necessarily piecemeal.

### The stocks perspective

The stocks perspective is an attempt to find an answer to the tension that exists between the diffuse totality of each actual problem and the (more or less) precise partial analyses produced by the disciplines concerned. Given this situation, the stocks framework and the heuristic based on it (presented in the next section) constitute a tangible means of gathering together knowledge relevant to sustainability policy, ordering it according to a common set of terms, and rendering it comprehensible to policy makers and their advisers.

Studying the way various elements are interconnected with one another is initially not so important for the stocks perspective. The aim first is to identify the elements relevant to a certain sustainability problem and to depict them in terms of their temporality. In other words, the stocks perspective sets aside the available systemic knowledge for a moment to highlight the aspect of time in relation to its objects of concern. This perspective assumes that the systemic knowledge available has already been reviewed and verified. The aim of temporarily bracketing out the systemic perspective and adopting a stocks perspective is to generate new knowledge at a higher level of cognition which can then itself be ordered systematically.



### The systemic perspective and stocks perspective

It is not possible to analyse a problem from the stocks perspective without first having adopted a systemic perspective. The starting point for this is preliminary knowledge that has been arranged in a more or less systematic manner – we might describe it as an ‘initial system’. Building on this, the stocks perspective seeks to identify the temporality of things. These insights are then embedded in a comprehensive systemic perspective to be rendered useful in terms of sustainability policy. Thus, the stocks perspective and the systemic perspective are not competing views; rather, they are two ways of identifying and depicting a sustainability problem, and it is possible – and necessary – to move back and forth between the two. (The schematic comparison of the systemic and the stocks perspective, shown in Klauer et al 2017: Table 3.1, provides an overview of the various approaches.)

The new knowledge gained from the stocks perspective should likewise not be construed as an attempt to construct a comprehensive system. Rather, the aim of this analytical process is to generate practical knowledge that is structured systematically and is tailored to address a specific sustainability problem. In addition to scientific knowledge, experiential knowledge and judgement should also feed into this process, and ignorance and uncertainty [IGNORANCE] should also be given consideration alongside inconsistencies and contradictions” (Klauer et al. 2017: 178-179).

## 2.4 The stocks framework: time, inherent time and dynamics, and judgement

### Time

“Sustainability in general requires a long-term timescale [BASICS OF TIME] because the impacts of today’s actions need to be considered not only in relation to the basic resources for life of those alive today but also to those of future generations [ABSOLUTE & RELATIVE SCARCITY]. For this reason, we need to be concerned with the temporal structures of things which are either durable in themselves or give rise to long-term effects. Terms that refer to the persistence and long-term nature of things include enduringness, inertia, stability, persistence, dynamic, change, upheavals, arising and passing away and, in the case of living things, living and dying [BASICS OF LIFE]. While such phenomena are addressed by the concept of stock, there are a number of concepts relating to the aspect of time which are preliminary to the stock concept. These concepts are *chronos*, inherent time and

inherent dynamic, and *Kairos* [BASICS OF TIME]. These are concepts that illuminate different aspects of time and simultaneously constitute different ways of addressing things in relation to time.

### Chronos

*Chronos* refers to time in its plain and empty progress. *Chronos* is the time that is counted in units of measurement and is measured using a time-measuring device (chronometer – clock). This time is imagined to exist independently of what happens within it. Time is measured as follows: Certain vibrations and movements of, say, a pendulum, quartz crystal or an atom are defined as regular, and all other temporal occurrences are set in relation to these regular movements. Everything that happens can be understood using a time index. This index makes it possible to

1. attribute a duration to a certain occurrence or course of events, expressed in numbers (e.g. lasts 3 minutes, 54 years etc.).
2. It also enables events or occurrences to be dated, that is, various occurrences or courses of events are set in a temporal relation to one another – before, afterwards or at the same time.

Depending on the approach taken toward time, it is perceived accordingly by a particular subject: *Chronos* corresponds to a ‘chronicler’ who lists occurrences and arranges them in a temporal order. Both physical and historical events and processes can be entered into the numerical framework of *chronos*.

The following definitions of time presuppose *chronos*, but in contrast to the latter, inherent time, inherent dynamic and *kairos* are not an empty measure but rather time filled with content. For this reason, the role of the subject when identifying inherent dynamic and *kairos* is different from that when measuring *chronos*.

### Inherent time and inherent dynamic

Objects possess a duration from their beginning (emergence, birth) to their end (disappearance, passing away, death). We refer to the *typical* duration of sequences of events, processes and life cycles as *inherent time*. It is the ‘internal’ time of things, so to speak – in the case of non-living things, their typical duration and in the case of living things, their normal lifetime. Inherent time is one of an object’s characteristics.

The inherent time of objects is a part of their *inherent dynamic*, i.e. the dynamic that is inherent to them. Inherent dynamic describes, in rough terms, the ‘natural course of things’,

in other words, typical developmental trajectories of observed objects. The scenario assumed here is one in which no deliberate intervention occurs to influence the dynamic. The operation and normal upkeep of a coal-fired power station, for example, is described by its inherent dynamic. This includes maintenance and, where necessary, the replacement of individual parts of the facility. Changing the facility into a gas-fired power station or decommissioning the entire plant and transforming it into an industrial monument would go beyond this inherent dynamic, as the character of the object would be fundamentally changed in the process.

There is a certain degree of leeway when it comes to distinguishing inherent dynamic from the dynamic driven by some kind of external influence on an object. The half life of uranium, for example, can be defined precisely (the half life of the uranium isotope  $^{238}\text{U}$  is 4.468 billion years), but such precision is more the exception than the rule. In a causal, dynamic theory that seeks to describe a given system in detail, it is generally not possible to strictly separate the two elements of dynamic, the inherent time and the inherent dynamic, from one another. The inherent dynamic referred to here, however, relates (from a phenomenological point of view) to *typical* temporal sequences of events in which non-typical external influences are bracketed out. Judgement is required to make this distinction. Thus, in general one considers the inherent dynamic for decision-making.

Determining inherent dynamic requires a subject with experience or knowledge of the set of circumstances in question, over and above the role of chronicler. For those who need to act, knowledge of the inherent dynamic of things within their domain of action is indispensable and often also taken for granted. The farmer is aware of the rhythms of the seasons, the crops and the animals he keeps; he will take these into account when making decisions in order to obtain good yields. The concept of inherent dynamic can be rendered more specific and tangible when it is applied, for example, to changes in stocks.

Inherent dynamic includes, in addition to the duration of things (inherent time), typical *rhythms* as they develop as well as the typical dynamics of stock variables. The term duration can be applied usefully to stocks, be they material or immaterial. Williamson (2000: 596 ff.) discusses immaterial stocks and suggests the typical duration of institutions, mentioning periods of years, decades and indeed centuries. Typical rhythms can often be found in the dynamic of natural systems, e.g. in forest succession, but also in the life cycle of a product in the economic sphere, for example. The exponential decay of radioactive material, mentioned above, is an example of the typical progression of a stock variable.

## Kairos

For people who want to achieve something and to act, *kairos* [BASICS OF TIME] is of utmost importance. *Kairos* is the right moment, the suitable opportunity. Those who manage to find the *kairos* do not act at an inopportune moment but rather at the right time. *Kairos* matches a subject who not only registers things (such as the chronicler) or acquires knowledge (like the observer of inherent dynamic) but who also has goals and the will to achieve them. A person who has such a will always observes a field of action with regard to potentially intervening in it. In doing so, she takes account of the inherent dynamics both of the objects themselves and of the ways they are interlinked. She looks for a window of opportunity in which she can take action and can influence the course of events. Looking at the inherent dynamics helps her to surmise or perceive an upcoming window of opportunity before it occurs and, if necessary, perhaps even to work towards it.

In order once more to illustrate by way of summary the differences between the three concepts of time, let us look at the example of the meaning of the word 'year'. In the sense of *chronos*, a year is simply the period of time taken up by 31,556,952 seconds. The inherent dynamic of a year can be described as the succession of the four seasons or of the feast days in the church year. In the sense of *kairos*, spring is the right time to sow and late summer the right time to harvest.

One might justifiably say that reading the time off a clock requires less judgement than comprehending inherent dynamic or discovering the *kairos*. Whereas *chronos* is something absolute, inherent dynamic and *kairos* are relational. Inherent dynamic is a property of an object, and *kairos* is related to an action.

## Stocks

We introduced the concept of stock [BASICS OF LIFE] in order to address objects from the point of view of their temporal development (enduringness, change, arising, passing away) – i.e. their inherent dynamic – and to distinguish between them accordingly. The inertia and stability of things point to their persistence. A stock is always something that exists for (a certain) duration. It is precisely this property that makes stocks an interesting object of study when it comes to analysing long term developments and seeking to achieve sustainability.

Every stock is accompanied by change. The arising and the passing away of stocks constitute extreme changes. In between the two lies the lifetime, or duration, of a stock. Even during its lifetime, a stock is typically subject to changes which, however, do not completely alter its essential nature. Something which is 'eternal' – e.g. the sun in relation

to human timescales – should not be described as a stock, and neither should something that is volatile in relation to a problem-related timescale in the sense that it arises and instantaneously disappears – e.g. noise. Thus, stock is an intermediate term between the eternal and the present moment. To the extent that a typical lifetime or typical rhythms of change can be identified for stocks, one can speak of their inherent time and inherent dynamic. Stocks can be categorised as material or immaterial.

### Material stocks

We describe a set of material things that exists over a certain span of time as a material stock. The precise nature of this set is established according to a property of appertinment. This says which elements belong to the stock and which do not. The set is described as persistent if it never completely disappears for the duration of its existence. Duration is measured on a timescale that depends on the individual observer's or policy maker's cognitive interest.

In the context of sustainability policy, we assume that the individual concerned will be guided in her cognitive interest by her interest in pursuing sustainable development. Accordingly, she will define the stocks concerned by means of the relevant properties of appertinment in such a way that she can gain insight into the options for and limits to action.

### Immaterial stocks

Non-material objects also possess persistence, duration and inertia as major temporal properties. Among the things that have the character of stocks in this sense are institutions, values, norms, convictions, preferences, habits, traditions, technologies and so on. These objects cannot always be clearly defined apart from their setting, and their stock-like character is not directly observable. Values and convictions, for example, can be articulated and preferences in consumer behaviour can become manifest, but this does not say anything about their persistence.

These objects – not least among them, institutions – are especially important in relation to the question of how to support sustainable development. On the one hand, institutions constitute pre-given (short and medium-term) conditions for individual and collective action while, on the other hand, they can be influenced directly by political action (unlike values, preferences, knowledge and technologies). Thus, they are – albeit generally only in the medium and long term – the object of political action aimed at influencing people's future behaviour. Institutions impact upon values, preferences and interests, both individually and

collectively. The use of technologies is also influenced by the relevant institutional setting. Desired changes in values, preferences, knowledge, interests and technologies can be brought about politically – if at all – only by shaping or influencing institutions. It is crucial to understand institutions in their stability and persistence in order to influence them in particular ways, and this in turn is hugely important for any sustainability policy.

By ‘institutions’ we mean rules-in-effect which are manifested from an external perspective through repetitive patterns of behaviour. As such, rules and patterns of behaviour are in some respect two complementary ways of representing the same object from two different perspectives. These two aspects belong together like the two sides of a coin. One important difference between them, however, is the following:

- Patterns of behaviour can be observed directly, therefore they constitute the ‘outside’, as it were, of institutions.
- Whether or not a rule – be it formal, such as a law, or informal, such as a convention or mode of interaction – is effective cannot be observed directly but can only be discerned through reflection. The rules and their factual validity are thus the ‘inside’, as it were, of institutions. For example, whether or not a rule is in effect can only be ascertained indirectly from people’s behaviour, from surveys, from introspection or from a shared view of the world (‘that’s the way it is’).

A complete description of institutions always encompasses both the ‘inside perspective’ of the rule and the ‘outside perspective’ of the behaviour. Neither of the two aspects on its own is sufficient. There are various concepts of institution in the social sciences. The term we use here can be viewed in the context of both philosophical institutional theories, such as that of Arnold Gehlen, and economic institutional theories. By looking at (persistent) institutions as immaterial stocks, however, we are emphasising the element of time in a particular way.

The persistence of institutions is manifested in a repetition of behavioural patterns that is subject to particular rhythms, in behaviour that regularly appears and disappears. The source of this persistence lies not only in what the institutions specifically do to fulfil the purpose for which they came into being. Rather, institutions can continue to exist even if they do not fulfil their original purpose. This is because people may perceive their persistence as a value in itself, namely, whenever a large number of people in a society have a pronounced preference for security and stability in their life, towards which institutions for their part contribute.

## Judgement

Judgement refers to the faculty for relating general principles (e.g. scientific theories and laws, legal norms or ethical postulates) to specific individual cases and practical situations. Thus, judgement is the ability to handle these general principles correctly in concrete situations, i.e. to apply them in the appropriate way and to render them meaningful for the here and now. In addition to directly applying the general principles ('This is a case of...'), this can also mean that they need to be modified and extended in order to do justice to conflicting aspects and to avoid succumbing to dogmas. Judgement is needed by all those who are contemplating an arena of action and who want to – or should – understand it and possibly intervene actively in it.

Judgement always relates to concrete situations; its domain is the particularity of these situations. Furthermore, judgement proceeds heuristically, i.e. it is guided by general procedural rules, so-called bridging principles, which it uses to work on the situation in question. What needs to be established in the course of this is whether or not the general procedural rule actually fits the particular case in question, whether or not the premises are really fulfilled and whether or not there are other particularities which render its use problematic. In reality one can never be completely sure *a priori* that these conditions are actually given. In addition to suitable heuristics, judgement also needs a flash of creativity, a way of approaching its object playfully. For this, the person concerned needs to have a feeling for the situation – something that can (at least in part) be learned and practised over long years of practical experience.

When hearing evidence in a court case, for example, judges have certain procedural rules that guide them through the complicated circumstances presented in the case. Nonetheless there often comes a point in the process of deciding upon the guilt or innocence of an accused person where this cannot be settled with ultimate clarity by mechanically applying the trial rules. Thus, there is no readily available universally valid procedure for judgement in the sense of an algorithm that consistently leads to completely reproducible outcomes or results. Exercising judgement always involves an awareness of the limited nature of the human mind and of its fallibility.

However, in order to ensure that the exercise of judgement does not lead to arbitrary outcomes, it works with the heuristics mentioned above. One example is the rule 'In case of doubt, in favour of the accused'. Additionally, though, the feeling for a situation mentioned above acquires intersubjective validity by the fact that the person judging has to justify and defend her judgement (either explicitly or implicitly) in discourse, thereby taking account of the imaginary positions of the others involved. (Klauer et al. 2017: 180-186)

## 2.5 The stocks framework as a heuristic for sustainability policies

“The more complex the terrain – the less standardised the problem to be solved and the greater the lack of knowledge involved – the less it helps to apply standardised schemes in a mechanical way to solve the problem; it is here that the faculty of judgement acquires its considerable significance. Sustainability policy constitutes precisely such terrain, being highly complex and involving a large number of unknowns. It therefore calls for especially well-honed judgement.

This appeal to judgement should not be taken to mean that a person should merely point to their intuition or gut feeling (something they either have or do not have) when making a decision. Rather, the outcomes that emerge from applying the faculty of judgement should also adhere to certain criteria – points of orientation, guidelines and procedural rules, heuristics – which help to provide a rationale for judgements and to make them comprehensible and communicable. (As mentioned in *BASICS OF TIME*, a heuristics is the art of finding something that cannot simply be concluded or deduced from our knowledge, such as a scientific law, a solution to a problem, or a good decision, see in particular Section 3.5) – Points of orientation and guidelines help to ensure that the goal always remains in view during the process of problem solving, while procedural rules give an idea of how to proceed on terrain that is initially complicated and seemingly impenetrable. A procedural rule differs from a law of nature or an algorithm in that it represents a rule of thumb and explicitly allows for exceptions.

### Formulating a heuristic

In the following we propose a heuristic [for an extensive explanation of the term see *BASICS OF TIME*] which is based on the core elements of the stocks framework and offers guidelines, questions and procedural rules to help the sustainability policy maker get a reasonable overall picture of a given sustainability problem. This picture should be neither too simple nor too complex. The aim of the heuristic is to achieve an accurate and workable definition of a sustainability problem, to establish what needs to be done in response, and to recognise or discover potential options for action. Applying the heuristic requires judgement, yet at the same time it provides information on which judgement can draw to determine what is to be done. The heuristic cannot be used like a recipe, however; it is more like a general guideline that enables a problem to be unpacked so that is then amenable to potential practical solutions.



### The importance of defining the problem

Defining a problem is the prerequisite for selecting specific instruments and measures to deal with it. Our motivation in developing the heuristic is our experience that *defining* problems is given far less attention than *solving* them – in both academic and policy settings. This is despite the fact that identifying the issues involved is usually no trivial matter and constitutes an important step towards solving the problem itself. Economic theories of decision making as well as technical decision-support procedures nearly always presuppose that the problem has already been properly and conclusively defined. Yet defining the problem in a ‘quick and dirty’ way regularly leads to wrongheaded policy recommendations, to policies that remain merely symbolic and to the use of the wrong policy instruments” (Klauer et al. 2017: 180-187).

### The heuristic of the stock framework: 7 steps

“1. Become aware of existing knowledge, review prevailing opinions, conjectures and insights.

*There is no such thing as starting from scratch when it comes to understanding something. Every act of understanding involves a prior understanding that needs to be clarified. Existing knowledge needs to be verified and placed in a provisional order, pre-judgements need to be articulated and thereby subjected to critical examination. As the process of knowledge acquisition moves forward, all preconceived views and evaluations as well as all apparent knowledge needs to be tested and confirmed, modified or rejected. Pre-judgements that cannot be dropped are obstacles to understanding”* (Klauer et al. 2017: 187).

2. Develop ideas for sustainability and frame the problem.

*“In order to know what kinds of changes ought to be brought about, we need an idea of what we are aiming to achieve – of what is not yet a reality but can possibly become one if we act appropriately. Utopian visions can help us develop such ideals. Utopias are ideas about how the world ideally ought to be. They are not usually put into practice, but they do provide orientation for articulating ideals and for shaping reality accordingly”* (Klauer et al. 2017: 188).

3. “Identify relevant stocks.

*Relations of cause and effect are often apparent to only a very limited extent – especially when it comes to human interactions and the relationship between humans and the environment. In addition, it is often unclear how much significance should be attributed to certain causes and how far they contribute to certain effects, while a host of causal relations gives rise to an extremely complex set of problems. In this context the stocks framework offers an alternative perspective that initially shifts this host of (not entirely certain or clear) causal relations into the background. This serves to reduce the complexity involved. At the same time the stocks perspective enables us to get a clear view of the temporal and long-term trends relating to factors that are regarded as essential" (Klauer et al. 2017: 189).*

#### 4. "Describe the inherent dynamic of these stocks.

*Working on sustainability problems requires a long-term perspective. For this reason, temporal processes play an especially prominent role in sustainability policy. Even if everything is subject to flux and change, stocks can steer our attention toward what exists over a longer period of time, and they enable us to speak about the future. They convey a feeling for the temporal structures involved – in other words, they give the policy actor a sense of time" (Klauer et al. 2017: 191).*

#### 5. "Sort through and order knowledge about the relevant stocks and their inherent dynamics and integrate it into an overall picture.

*Once the particulars have been examined in and of themselves, the next step is to examine the whole and to look at the larger context. As far as is possible, the available knowledge from both scholarly and experiential sources should be integrated into the picture of the whole. At the same time, it is ordered and structured so that what is important is brought to the fore and what is less important remains in the background. Viewed through the stocks perspective, this overall picture is neither a snapshot nor an isolated scenario but rather encompasses various trends and potential futures. In particular it should enable us to see what we will be bequeathing future generations if we do nothing (in relation to sustainability)" (Klauer et al. 2017: 192).*

#### 6. "Formulate concrete sustainability objectives.

*The things we bequeath to future generations in terms of material stocks, institutions and knowledge will influence the way they judge us. How do we want to live on in their memory? What bequest of material and immaterial stocks do we think constitutes a fitting foundation on which future generations can build their lives? The notion of a 'fair' bequest, however,*

*is initially just that – an idea. In order for this idea to guide us in our actions, it must lead to tangible sustainability goals for the set of problems under consideration.*

*The current generation cannot guarantee that in the distant future the world will exist in some kind of desirable state – this is beyond humanity’s capacity to influence. Nonetheless current generations do bear responsibility for the state of nature, the economy, society and politics that they pass on to subsequent generations. This state, which we call ‘bequest’, is made up of stocks. We might say, then, that the responsibility of current generations to ensure sustainable development lies in passing on to their children a ‘fair bequest package’ (Norton and Toman 1997) to the extent that it is within their power to do so” (Klauer et al. 2017: 194).*

### 7. “Identify the sustainability problem and what needs to be done.

*The heuristic is brought to a conclusion in Step 7. Following a more or less diffuse articulation of the sustainability-related problem in the preceding steps, it is now delineated precisely and described in terms of its essential structures; the specific action required is then fleshed out. It may be that the mere process of clearly describing the need for action already points to ways of solving the problem. However, the task of actively developing options for action is not part of the heuristic itself but rather constitutes a stage beyond it” (Klauer et al. 2017: 191; for more details see 195 ff.).*

“Although these steps prescribe a linear progression, it is certainly legitimate to diverge from it should circumstances require. For example, some steps or sequences of steps may need to be gone through several times in an iterative manner, and it may be advisable to look back over the steps already taken in order to ensure they have been dealt with properly” (Klauer et al. 2017: 187; the seven steps are described in more detail in Klauer et al. 2017: 187-199).

## 3. Practice

We want to show how our conceptual method, the framework of stocks, can be employed to analyse a concrete example, the inland shipping policy in Germany (Section 3.1). In Section 3.2. we examine how politicians can manage this task. To this end, we proceed in seven steps, starting with the policy aims and relevant facts known about German inland shipping (steps 1 and 2). This enables us to identify the relevant material and immaterial stocks and their (inherent) dynamics (steps 3 and 4). This enables us to develop an overall picture (step 5). We can then summarise the normative demands placed on German inland

shipping policy by the general principle of sustainability and formulate concrete goals. Finally, we place the key elements of a sustainable inland shipping policy (Step 6) in relation to the current situation in order to propose concrete policy recommendations for the transportation system (step 7). Section 3.3 deals with right time for action. In Section 3.4 we offer some general reflections on our procedure. Finally, a concise summary is given as to how the stocks framework can be employed as a lesson in long-term thinking (Section 3.5).

### 3.1 Applying the heuristic to inland shipping policy

An old English saying goes, the proof of the pudding is in the eating. We, therefore, want to “apply the heuristic for sustainability policy [SUSTAINABILITY & JUSTICE] developed in the BASICS OF TIME, Sections 3.4 to 3.6 (for more details see Klauer et al. 2017: chapter 11) to a practical case study to illustrate how it works. In the following brief study, we examine how political decision makers can manage inland shipping in Germany in a sustainable way – or at least in a way that is more sustainable than at present. It is based on Klauer and Gunkel (2009). Our main focus at this point, however, is on method. Using this example, we want to demonstrate that the heuristic developed in the previous chapter can be put to practical use to generate a rough overall picture of a given problem using relatively simple means, to outline the need for action and, where necessary, to gain pointers toward options for action and windows of opportunity for implementing them. The example is also provided as an illustration of how to make the abstract and rather general description given in the previous chapter easier to understand. There are two things we wish to highlight in particular:

- We deliberately do not describe the process of the heuristic in relation to a real-life situation involving policy advice or decision making.
- Given that our main interest lies with the method, we give only a cursory account of inland shipping. We attempt to show, in short sharp fashion, how readily accessible items of information can be pieced together to generate a preliminary yet fairly robust picture of inland shipping in Germany.

It is in the nature of a heuristic that the information it helps to generate is neither inevitable nor incontrovertible. Of course, it is always possible to arrive at the same information by another route, that is, without the heuristic. The heuristic, then, is merely a device designed to help the enquirer move systematically along a path toward sustainable solutions. It cannot, however, be applied in a purely schematic or automatic way but rather requires

expert understanding and the faculty of judgement [Power of Judgement]” (Klauer et al. 2017: 201).

### 3.2 How can politicians manage inland shipping in Germany in a sustainable way?

In 2009, the coalition treaty between the conservative CDU and the liberal FDP explicitly stated the importance of sustainability in German inland shipping: “Free flowing rivers are highly valuable in ecological terms” (Coalition treaty between CDU, CSU and FDP, 17<sup>th</sup> legislative period 2009-2013: 23). In particular, the intention was formulated “to give the national waterways greater priority when it comes to disbursing investment funding. We will remove unnecessary bureaucratic obstacles to shipping and put forward a draft law aimed at reforming the Waterways and Shipping Administration” (Klauer et al. 2017: 202).

We want to employ the seven steps of the heuristic developed in Section 3.2 above “to find out what the sustainability problems are in relation to German inland shipping policy and where there is need for action” (Klauer et al. 2017: 202). To this end, we have first to look at important facts about German inland shipping.

#### Step 1 – Become aware of prior knowledge about German inland shipping

“Waterway transport on Germany’s rivers and canals goes back more than a thousand years. It enables goods to be transported in large quantities. For this to occur, of course, it has to use existing waterways. Centres of industrial production have consequently sprung up time and again in exactly those places where access to rivers is easy. Canals were additionally built in order to establish connecting routes between the natural waterways.

Important inland waterways in Germany include the rivers Rhine, Mosel, Neckar and the Midland Canal which extends east -to west across the northern part of Germany. The main bulk items transported along these waterways are gravel, coal, mineral ores, and scrap metal. However, container shipping has become increasingly prevalent in the last few years. Inland shipping is important for the port of Hamburg and other large ocean ports in terms of linking them up with the interior. The inland waterways capable of handling goods transportation are among the so-called federal waterways and are under the administration of a national agency rather than of individual federal states, unlike other bodies of water.

Inland waterway transport on the federal waterways requires good and reliable navigation conditions, as far as is possible – in other words, waterways should be passable throughout

the year wherever possible, with a sufficient depth and no significant obstacles. In order to do justice to these requirements and also to allow flood water to run off more easily, the waterways have been and are being improved and continuously maintained. As a result, most waterways are non-natural, technically altered stretches of water containing very different species than they otherwise would and fulfilling a limited role as flood barriers. Rivers in a near-natural state – of which there are hardly any left in Germany – offer poor conditions for shipping. They are generally characterised by changing water levels, shifting riverbeds and shifting sand banks, potholes and shallows – all in all, then, a highly dynamic riverscape.

There has frequently been heated debate among experts and the general public in the past – some lasting for years or even decades – about the pros and cons of expanding Germany's rivers into navigable waterways and maintaining them over the long term as well as about canal building projects. Well-known examples include the controversy over the construction of the Rhine-Main-Danube canal (cf. Glas 1996), the expansion of the river Saale (cf. Petry and Klauer 2005) and maintenance activities on the river Elbe (cf. Petschow and Wlodarski 2009).

### Step 2 – Briefly consider relevant aspects of sustainability and develop ideas for sustainable inland shipping

What does 'sustainability' mean in the context of inland shipping policy? Generally speaking, sustainability [SUSTAINABILITY & JUSTICE] is a normative model to which the German government has committed itself, in part in its national sustainability strategy entitled 'Perspectives for Germany' (German Federal Government 2002). Sustainability demands that the different interests of current and future generations [INDIVIDUAL, COMMUNITY & ENTIRETY] be balanced in a fair manner and that the natural conditions necessary for human survival should be preserved. To do justice to this model it is necessary to adopt a long-term perspective [BASICS OF TIME] and to take account, for example, of the impacts of demographic change, climate change, globalisation and the development of the economic structure from an industrial to a service-based economy when looking towards the future and deciding what policy action to take.

Sustainability, then, is initially an abstract demand which needs to be rendered specific in relation to inland shipping in order to be politically effective and provide practical guidance in individual cases. This macro-social task entails formulating an idea about what structure our economic development in general and inland shipping in particular should have, what transportation ideals are important to us, what features functioning habitats, landscapes and infrastructures should possess and how strictly or loosely nature and environmental

conservation should be handled [TELEOLOGICAL CONCEPT OF NATURE]. In other words, sustainable shipping policy cannot be designed in isolation from macro-social and economic development and certainly not from other domains of transportation policy – indeed it must be integrated into these.

Neither the above mentioned coalition treaty nor the relevant legislation offers any clear answers to these questions. The national sustainability strategy contains the vague and currently rather unrealistic demand to decouple the development of motorised transportation from economic growth (German Federal Government 2002: 111). An ideal scenario (impossible to achieve) would seek to have both at the same time – inexpensive goods transportation that is environmentally sound and uses up fewer resources alongside (cultural) landscapes that are as close to natural as possible. However, because these options are mutually exclusive in a single location (at least given existing technologies), it is necessary to deal with the conflict that exists between creating the best possible shipping conditions on the one hand and preserving or re-creating river stretches in their natural state on the other. One important approach to balancing these different objectives is to establish spatial priorities for goods transportation and nature-like landscapes in such a way that both can be regarded as being met on a larger scale.

The policy strategies quoted above neither address the conflict between the different objectives nor do they take account of the possible approach to dealing with them just mentioned. This suggests that the debate about the different objectives of creating optimum shipping conditions and preserving natural rivers and river meadows has not yet been conducted to the point of resolution in Germany.

### Steps 3 and 4 – What are the relevant stocks associated with German inland shipping and what are their (inherent) dynamics?

In order to avoid redundancies and too much complexity, we will concentrate in the following on presenting a few stocks that are especially relevant to the issue of inland shipping (Step 3) and give an account of their dynamics (Step 4). We will describe the temporal development of the material stocks mainly using statistics and that of the immaterial stocks using a qualitative approach.

#### Material stocks

The Federal Republic of Germany is an industrialised country that depends upon an intact transportation infrastructure. Germany does indeed have a densely woven, properly functioning network of roads, railway routes and national waterways. There are airports,

pipelines, multi-modal harbours (ocean and inland), freight centres, a large fleet of goods lorries, railway rolling stock and an inland shipping fleet. A network of private sector and publicly owned companies as well as government administrations organises goods traffic and keeps it running.

There are currently some 7,350 km of inland waterways in Germany, of which approx. 6,600 km are inland shipping waterways and some 750 km waterways for ocean-going vessels. Among the most important inland waterways for ocean-going vessels are the Lower Elbe, which connects Hamburg harbour to the North Sea, and the North Sea-Baltic Sea canal. 35% of the entire network of inland waterways consists of free flowing stretches of river, 41% are stretches managed using weirs, and 24% are canals (BMVBS 2010: 290, Online References).

### The role of inland shipping in transportation

If we look at the role of inland shipping within the overall context of goods transportation the following picture emerges: Whereas the volume of freight and thus the demands placed on the transport network have grown steadily over the years overall, the tonnes per kilometre transported using inland shipping has stagnated to an almost constant level over the last ten years. By contrast, rail freight has grown slowly while road freight has grown rapidly (see for example the illustrations of Bundesverband Güterkraftverkehr, Logistik und Entsorgung 2010, Online-References).

In the so-called modal split between the various forms of freight transport, inland shipping accounts for far less than 10% of total freight transport, with a declining trend. The German government's current prediction regarding the future of freight transport to the year 2050 (Ickert et al. 2007: 4) is that the proportion of freight accounted for by inland shipping will continue to decline in the modal split, whereas that of rail and road freight will increase slightly. In absolute figures, though, the prediction is for there to be a surge of growth in all forms of freight transportation. Inland shipping is predicted to see a growth rate of 36.3% by 2030 and of 56.6% by 2050 (in each case using 2005 as the base year) (ibid.). Predictions over such a long period of time should be treated with caution [IGNORANCE], of course, given that they assume there will be no structural breaks along the way. Nonetheless it does not appear unreasonable to assume that all forms of transportation will see a marked increase in freight traffic even as the relative significance of inland shipping declines (cf. Petschow and Wlodarski 2009: 73-74).

### Immaterial stocks: transportation infrastructure



Transport volumes are a good indicator of the potential development of the *material stocks* that comprise them, i.e. transportation infrastructures on the one hand and corresponding infrastructures in the economy on the other. Much harder to capture than roads, railways and waterways and the lorries, trains and ships that use them, though, are the *immaterial stocks* that give rise to these increasing transport volumes, or rather make them possible. Clearly, however, there is an uninterrupted growing need for transport capacity, which enables us to draw conclusions about the way our economy – based as it is on the division of labour and on growth – works as well as about consumer behaviour.

One important *institution* for dealing with the dynamic of this demand is Federal Transport Infrastructure Planning. Every ten or fifteen years the German government adopts a Federal Transport Infrastructure Plan in which investments in the transport infrastructure are set out for the following ten to fifteen years. The last Federal Transport Infrastructure Plan in 2003 foresaw an investment volume of approximately 150 billion euros (BMVBW 2003: 70). The plans are drawn up on the basis of extensive traffic predictions using an analytical method that is essentially based on cost-benefit considerations (BMVBW 2002). Decisions regarding the proposed transport infrastructure projects are taken individually – regardless of whether or not they are to be considered as priorities. There is no real overall planning across the different forms of transportation. In particular, investments in the road and rail networks are planned largely independently of those in the waterways network” (Klauer et al 2017: 202-207; for more details see 207).

### Stocks relevant to environmental protection and conservation

“Having looked first at some material and immaterial stocks in the transport sector, we now turn to stocks which are relevant to environmental protection and nature conservation. We focus here on two important factors, namely:

- 1) the stock of near-natural river meadows and
- 2) the condition of German water bodies according to the criteria contained in the European Water Framework Directive.

Near-natural river meadows and flood plains are important as retention areas for preventive flood protection, and they fulfil a variety of ecosystem functions – especially nutrient retention, self-purification and habitat provision for a large number of rare plants and animals. They are important leisure destinations for city dwellers and also constitute transregional axes for habitat connectivity.

The ecological situation of Germany’s waterways can currently be described as critical. For example, the Federal Agency for Nature Conservation’s report on the state of river

meadows states that, particularly alongside the country's larger rivers, 'intensive use of river meadows, dike construction, the expansion of water bodies and dam facilities have led to considerable losses of natural flood plains and to extensive changes in the condition of river meadows', which is associated with a marked decline in biological diversity (BMU, BfN 2009: 10). Shipping requires the expansion of waterways, continual maintenance work and dam facilities and thus clashes with the preservation of near-natural river meadows. Only around 5,700 ha of near-natural hardwood woodlands remain along riversides in Germany, which is less than 1% of the original stock. Swamp areas which, if left to themselves, would take up large amounts of land, constitute only approximately 2% of floodplain meadows (10,000 ha) and much less than 1% of ancient river meadows" (Klauer et al. 2017: 208).

### Step 5 – Sort existing knowledge and integrate it into an overall picture

"Steps 3 ('determine relevant stocks'), 4 ('determine their inherent dynamics') and 5 ('sort existing knowledge and integrate it into an overall picture'), which are kept separate for analytical reasons in the heuristic, are not always easy to distinguish in practice. This is not a problem as long as the issues are taken into account and addressed. In our brief case study on sustainable inland shipping we have not presented our description of the relevant stocks separately from our description of their dynamics. Additionally, in the previous section relationships between the various stocks were identified either explicitly or implicitly so that the individual facts gradually came together to form an overall picture. In our account of Step 5, we will now identify explicitly a number of other relationships and attempt to bring a more systematic arrangement to the picture.

### Relevant stocks developing over time

In Figure 12.3 we have grouped together some of the relevant stocks, indicated how they may develop over time, and placed them in relation to the sustainability goals with which these trends come into conflict. As indicated in Figures 12.1 and 12.2 as well as by the transport ministry's predictions (Ickert et al. 2007), Figure 12.3 also shows that the number of goods lorries is set to increase steadily and that there will be no shift from roads to inland shipping but rather, if anything, fierce competition will ensue between the railways and shipping. Hence the need for waterways will not grow any further. Nonetheless, investment in facilities such as fish ladders at barrages is still needed in order to achieve at least some degree of balance between the goals of 'protecting water bodies' and maintaining a 'good transport infrastructure', even if transport capacity remains stagnant.

### Conflicts between different sustainability goals

The conflicts that arise between different sustainability goals cannot always be resolved by technical means, however. The maintenance measures undertaken along shipping routes usually have an adverse impact on the adjacent river meadows and thus indirectly on water status. Beneficial shipping conditions and near-natural rivers and meadows are extremely difficult to achieve along the same section of river. Given this sustainability conflict (which we mentioned briefly in Step 2) and on the basis of the inventory presented above, therefore, we wish to conduct a more detailed breakdown of the shipping routes and find out where goods transportation actually happens. This information was not included in the stock analysis in Steps 1 to 4, but it is important when it comes to formulating spatial priorities for achieving the different goals of sustainability – for goods transportation on the one hand and for near-natural rivers and meadows on the other.

For this purpose, the entire stock of Germany's waterways is divided up into separate stretches of rivers and canals, and the amount of goods transported annually is ascertained for these sub-stocks. Figure 12.4 shows that the overwhelming proportion of goods transported on Germany's waterways is carried on the Rhine and on the Lower Elbe northwest of Hamburg (though the Lower Elbe is classified as a maritime waterway). Other heavily frequented inland shipping routes include the east-west Midland Canal, the Dortmund-Ems Canal, the Elbe Lateral Canal, the Mosel, the Main and the Neckar. In contrast to these, hardly any goods transportation occurs on other stretches of the German waterways network.

It is likely that the spatial distribution of goods transportation in the future will not be subject to any great change and that at most the differences will grow larger. Studies conducted by the Potsdam Institute for Climate Impact Research, the Helmholtz Centre for Environmental Research and other research institutions show, for example, that as a result of climate change the shipping conditions on the Elbe over the coming decades will deteriorate markedly (PIK 2009). Conditions on the Rhine, by contrast, are affected less by climatic changes.

### Combined effect of informal and formal institutions

Let us now consider the combined effect of informal and formal institutions which regulate decisions regarding the waterways network. The complexity of factors involved in balancing the different requirements of bodies of water is often simplified in policy debates – and sometimes even in expert debates as well. Debates about expansion plans for the river Saale, for example, continue to be dominated by the mindsets outlined in Steps 3 and

4 above relating to environmentally friendly inland shipping, which its proponents wish to promote in order to shift goods from the roads onto the rivers and to give the region an economic boost which, it is hoped, will ultimately create more jobs.

However, it is not only the policy debate between the relevant organisations and interest groups that fails to take adequate account of the complexity of the infrastructure system and the multitude of demands that are made on it: The formal institution Federal Transport Infrastructure Planning does the same – even though it is based on a far-reaching and comparatively well documented method (see BMVBW 2002 and Petry and Klauer 2005). The plans predicting the needs for various forms of transportation – roads, rail and waterways – are still drawn up largely independently of one another.

In summary, it can be said that the interests, mindsets and patterns of argumentation adopted by the Waterways and Shipping Administration and the representatives of inland shipping as well as the regulations stipulated by nationwide transportation planning lead to a pronounced inertia that stands in the way of any reform of institutions and ultimately of any attempt to examine the fitness for purpose of the waterways network.

#### Step 6 –The key elements of a sustainable inland shipping policy: concrete sustainability goals

Having analysed the current situation of inland shipping and its predicted trends, we can now summarise the normative demands placed on German inland shipping policy by the general principle of sustainability in terms of the following key elements:

- *Limits to growth*: Goods traffic should not grow unchecked because it does not contribute directly to an increase in well-being but rather serves merely to distribute production materials and consumer goods. In this respect an important sustainability goal consists in decoupling future transportation trends, economic growth and social well-being from one another. Thus, one key element would be the goal postulated by the German government in its sustainability strategy (German Federal Government 2002: 111): ‘...to induce a similar development in transportation sector as has already been achieved in the energy sector, i.e. to decouple economic performance from transport capacity. Towards this end we seek to achieve a reduction in transport intensity [i.e. tonne kilometres or passenger kilometres per GDP] by around 5% in goods transportation and 20% in personal transportation by 2020 as against 1999 levels.’ This means likewise limiting the amount of area taken up by transportation routes.

- *An efficient infrastructure geared towards needs:* The enormous sums spent on maintaining and investing in the waterway's infrastructure should be justified on economic grounds. Currently it is doubtful whether some of Germany's waterways are economically efficient when one sets the costs of maintenance against the transportation benefits. This makes it appropriate to examine economic efficiency not only in relation to investment in expansion projects but also in relation to maintenance measures.
- *Balancing interests fairly:* A comprehensive process of deliberation will take account not only of the interests of businesses in inexpensive goods transportation but also of the interests of current and future generations in terms of access to a healthy natural environment and life-enhancing landscapes. The species diversity that exists in river meadows is a major reason why they require even greater protection than other natural habitats. (BMU 2007). In particular it is important to note that there is currently a largely irresolvable conflict at the local level between waterways expansion for shipping and the goal of preserving a near-natural structure of Germany's waterways.
- *Institutional development of the German Waterways and Shipping Administration (WSV):* With regard to its organisational structures the WSV needs to be reformed in such a way that not only the interests of inland shipping – to ensure that shipping conditions are as beneficial as possible – but also the opposing interests regarding maintaining near-natural conditions for water bodies are systematically taken into account.
- *Integrative planning:* Roads, railways and rivers and the modes of transportation they support are interconnected and, to an extent, act as substitutes for one another. The predicted needs set out in nationwide transportation plans have thus far given insufficient consideration to this fact. The methods used by Federal Transport Infrastructure Planning (according to which the plans for road, rail and waterways projects are drawn up largely independently of one another) ought in the future to be geared towards drawing up systematic, integrated plans for all the transportation networks.

#### Step 7 – Define the sustainability problem and outline the need for action

The task at this point is to place the key elements of a sustainable inland shipping policy (Step 6) in relation to the current situation (Steps 3, 4 and 5) in order to identify where and how it is appropriate to intervene in the transportation system.

### Examine the Federal Waterways Network in terms of economic efficiency and formulate priorities for use

The Rhine as well as several other canals and rivers are used intensively for goods transportation and therefore play an important role on the macroeconomic scale. At the same time, river meadows are the most species-rich habitats in central Europe. Looking at Germany as a whole, it seems sensible not to treat all bodies of water the same way. Instead, it makes sense to distinguish between rivers whose use as inland shipping routes is of prime importance (as will certainly be the case with the Rhine) and rivers whose near-natural status is primary. At this time the last remaining near-natural rivers and floodplains in Germany are threatened by planned improvement projects and by the impacts of current building activities. This is especially the case on the middle and upper stretches of the Elbe and the Oder, where maintenance activities have been intensified, and on the Danube, where there are plans for improvements at Straubing-Vilshofen.

A large part of the current national waterways network is not (or no longer) used intensively for the transportation of goods. Classifying these bodies of water as national waterways generates constant pressure to improve or maintain them, even though the effort and expense involved is not matched by any significant benefit to the country's economy. If a waterway maintains its status as a national waterway but is allocated a lower waterway classification, this in itself can lead to lower spend on maintenance. Beyond this, those rivers and bodies of water which are not in intensive use should no longer be classified as national waterways, with responsibility for their upkeep transferred to the federal state in which they are located. This seems sensible not only for the purpose of reducing maintenance costs but also because it would make it easier administratively to implement the European Water Framework Directive for which the individual federal states are responsible. It may well be that the federal states will agree to this reclassification from the national to the regional level of responsibility only if they receive at least some transitional compensatory funding for taking on the burden of maintaining the bodies of water in question.

#### Summing up:

- Sustainable inland shipping should continue above all on those rivers that have already been improved for this purpose. There should be no further improvements and very little further maintenance undertaken on rivers which are unimportant economically or of special ecological value.

- The network of waterways in Germany as a whole should be examined in order to potentially reclassify individual waterways.

At this point we would like to mention an initiative currently being undertaken by the German Transport Ministry which actually does contain some of the key demands just mentioned. In 2012 the Ministry wrote on its website:

‘[The initiative] is based on a categorisation of the network of national waterways, underpinned by expert reports, which sets clear priorities for infrastructure financing and the intensity of waterways operation and maintenance. Within this network structure, a distinction will be made between those waterways with high transport capacity and those with little or no role in goods transportation. Category A is the highest category: They include inland waterways with more than 5 million tonnes of goods traffic each year. Category B waterways have between 3 and 5 million tonnes, Category C less than 3 million tonnes, and ‘others’ have no goods traffic.’ (Website of the German Transport Ministry, last access 14.09.2012).

What this means in practice is that low-traffic waterways – such as the Elbe south of Magdeburg and the Saale – are not to be improved at all but only maintained. However, the ministers for transport of the federal states of Saxony-Anhalt and Brandenburg are up in arms about this classification of the Elbe and the Saale. In response to them, the Federal Ministry of Transport on the same website:

‘We deploy resources according to need, not according to state boundaries. Our planning is based on realities – the conditions and facts of nature in Germany. 85% of inland shipping in Germany takes place on the Rhine and its tributaries – the same amount in a single week as takes place on all the other waterways combined in a year. [...] The optimistic predictions of growth in shipping for the new [former East] German states made in the 1990s have not come to pass. Further improvements are therefore neither necessary nor financially feasible in the foreseeable future.’

### Reform Germany’s Federal Waterways and Shipping Administration (WSV)

The WSV has enormous capacity in terms of staff and expertise. In the past, however, this has been directed mainly at creating the best possible conditions for shipping, whereas other tasks such as achieving the ecological objectives of the European Water Frame Directive (WFD) have not been tackled adequately (cf. BMVBS 2010: 290). In structural terms, one point of critique is that the WSV combines planning, implementation and approval in a single organisation. The aim of modern waterways legislation ought to be to make the planning of new waterways projects and of improvements to existing waterways

subject to monitoring by the legislative authorities. Coordination and consultation regarding work carried out by the WSV and work carried out by other authorities at national and federal state level that are responsible, among other things, for flood protection, implementing the WFD at water catchment level and nature conservation should be further improved (Möckel 2009). To sum up:

- It is imperative to examine the tasks and competencies of the WSV, to redefine them and, in the process, adapt the structures of all relevant agencies and authorities accordingly.
- Processes of consultation among the WSV and other national and federal state-level authorities should be optimised, and waterways legislation adopted accordingly.

Here too it should be noted that reform of the WSV is already underway and that, for example, the regional shipping directorates have been combined into a single general directorate based in Bonn. The Federal Ministry of Transport states in this regard (on the website referenced in note 16):

‘The structure and tasks of the Waterways and Shipping Administration – especially its representation in the regions – will be based on this network structure. This will involve, for example, pooling resources in agencies that specialise in specific tasks (e.g. expansion, nature conservation).’

#### Advance the methodological development of Federal Transport Infrastructure Planning

We do not wish to go into much detail regarding the need for action regarding Federal Transport Infrastructure Planning, as this would go beyond the focus of our analysis. Instead, we will simply state the following:

- Federal Transport Infrastructure Planning should be based on a concept of sustainable transportation and logistics and should be developed further into a planning instrument that includes and integrates all modes of transportation.
- The aim of decoupling economic development from the development of transportation should lead to specific measures aimed at limiting goods traffic” (Klauer et al. 2017: 209-216).



### 3.3 *Kairos* – the right time to act

“To what extent does this analysis of stocks and of their (inherent) dynamics enable us to discern the right time to act [BASICS OF TIME]? The data on trends in transportation tell us that the general rule ‘the sooner, the better’ applies to all the above mentioned needs for action. The areas where a need for action has been identified essentially relate to plans which, by their very nature, are only able to affect the environment in the long term. The analysis of stocks, however, shows that there are no fundamental obstacles to acting right away. The only question is whether or not the political will exists to do so.

The government coalition treaty of 2009, mentioned at the start of Section 3.2, indicates that in some areas there is indeed the will to undertake a reform of inland shipping policy. In particular, the treaty mentions the restructuring of the WSV. This intention is backed up additionally by the above mentioned reform of the WSV put forward by the Federal Ministry of Transport in spring 2011 and its associated procedure for prioritising investments in improvements in which the network of inland waterways is divided up into primary waterways, major waterways and subsidiary waterways (*Vorrang-, Haupt- und Nebenwasserstraßen*). This new categorisation of the waterways network makes it feasible to reduce the size of the waterways network and to re-dedicate largely unused stretches of waterway. This in turn would enable regulations to be devised that are beneficial to both the federal government and the federal states while not significantly harming shipping while still serving nature conservation and the protection of bodies of water. Despite this, there is likely to be resistance on the part of the WSV because its scope of influence is being reduced and on the part of the inland shipping organisations because the reduction of the waterways network can be seen as a sign that policy is shifting away from an increase in inland shipping – even if the stretches of waterway in question are ones that are more or less irrelevant to current and future waterway traffic. Additionally, a number of federal states in eastern Germany – supported by lobbyists – are putting up massive resistance because they fear they will be at a disadvantage in the distribution of investment funds by the federal government. Nonetheless a window of opportunity for new arrangements is currently available in this regard, and those in positions of responsibility seem to be taking advantage of it.

A new Federal Transport Infrastructure Plan is currently being devised. In this respect, too, the time would be right to introduce demands for planning that include greater consideration of all modes of transportation taken together in any review of methods. It may be that it is too late for this, however. With the update of the Water Management Act, responsibility for ensuring the passability of barrage facilities along the country’s inland

waterways was transferred to the WSV. As a result, the window of opportunity for drawing up more extensive regulations around the coordination of transport, water management and nature conservation planning appears to have closed for now” (Klauer et al. 2017: 216-17).

### 3.4 Reflection

“In the foregoing pages we have applied the heuristic developed in the concept BASICS OF TIME, Section 3.4 to 3.6 (for more details see Klauer et al. 2017: chapter 11) to the policy field of inland shipping. We have followed the steps set out in the heuristic and have taken account of its guidelines and rules wherever relevant. The kind of information evaluated was essentially that which is readily accessible in statistics or reports. One characteristic feature of our approach is that both quantitative and qualitative information as well as information about physical infrastructures and organisational arrangements – i.e. material and immaterial stocks – were evaluated in conjunction with one another. The very co-presentation of these different kinds of information makes it possible to discern linkages and interconnecting factors which may be surprising. By placing the analytic description in relation to sustainability goals it then becomes possible to work out what the need for action is. In other words, it was possible to generate contextual and practical knowledge.

To summarise, then: The heuristic takes as its point of departure both factual knowledge and knowledge of rules. How these separate pieces of information are selected, weighted and linked together, however, depends on the considerations, judgements and opinions applied to them – and that is the domain of the faculty of judgement [POWER OF JUDGEMENT]. When people use knowledge to underpin the decisions they make about how to act, this knowledge is typified by an interweaving of facts and judgements. The contextual and practical knowledge created by applying the heuristic is thus a synthesis of factual knowledge and knowledge of rules on the one hand and of experience, judgements and evaluative assessments on the other. To this extent the case study has illustrated how the concept of stocks and the heuristic derived from it can be understood as a bridging principle for purposes of judgement” (Klauer et al. 2017: 2-217).

### 3.5 The stocks framework: a lesson in long-term thinking

#### Begin with things as they are

“The idea of sustainability [SUSTAINABILITY & JUSTICE] ultimately calls for action in society, politics and academia. Sustainability demands that we take precautionary action [RESPONSIBILITY] to ensure the well-being of future generations, that we dismantle existing conditions of injustice between the rich and the poor and that we treat the natural environment with care. These demands are extremely demanding, both ethically and intellectually:

- From an ethical perspective, each person, society as a whole and above all those who represent certain groups of people [INDIVIDUAL, COMMUNITY & ENTIRETY] politically are called upon to take action against unjust conditions. This means striving to live life in such a way that it does not endanger the natural environment upon which human survival or indeed nature as a whole depends. When doing so, each person needs to ask themselves whether what they are doing right now is beneficial in the long term as well. In other words, they need to put all the things they do in their everyday lives to this test. In doing so they will probably discover that many of their actions – if not most of them – do not do justice to the demands of sustainability. Unlike ordinary citizens, politicians have an additional responsibility for collective action [RESPONSIBILITY].
- Intellectually speaking, sustainability demands that we are aware at all times of what is beneficial and how it can be achieved. Furthermore, any decisions that are made need to prove their worth over very long periods of time.

Demands of this kind can easily tip over into a sense of being overwhelming which, rather than stimulating action, threatens to stifle it. It is not uncommon for them to be clothed in quasi-religious rhetoric accompanied by an appeal to the authority of science. This is often followed by the demand for immediate change – a fundamental, rapid transformation of our modes of production and consumption and our way of life – because it is only this, so it is said, which can avert the disastrous consequences of climate change (to name an especially pressing sustainability problem). What we identify in such utterances is an exaggerated trust in academia, i.e. a lack of appreciation for its limitations, as well as an inflated estimation of the potential of our actions. On this basis, all attempts to solve serious problems of sustainability are doomed to failure from the start. The reality is too far removed from the ideal of a ‘sustainable world’ to be able bridge the gap within a short space of time.

The stocks framework developed in the course of this book is intended to provide a realistic, accessible way of approaching sustainability problems. It does not think in terms of goals that really ought to be achieved straight away. From the stocks perspective, sustainable action starts out not from a position of *what ought to be* – i.e. from an initially unachievable ideal – but from a position of *what is*. It is from here that it strives to achieve what is possible and within reach.

Of course, even this kind of sustainability goal is guided by an ideal, which is why the countless academic and non-academic articles that seek to unpack that normative ideal of sustainability and identify its constituent parts are necessary and valuable. Nevertheless, our own focus is not on ideas about what should or could be but rather on things as they are. This involves first honouring the present and the past as the initial conditions for action before looking at the future and what we want to achieve. The stocks framework illustrates clearly that although we may be able to achieve little in the short term, in the long term we can achieve a great deal. In this way it prevents us from lurching between overinflated optimism and doleful resignation.

#### A focus on ‘time’

The stocks framework starts out from the way things are in two respects:

- First, it is aimed at making existing knowledge – including imprecise, uncertain or subjective knowledge – as fully available as possible so that it can be used by those called upon to act.
- Second, reality is looked at in such a way that genuine options for action remain in focus. In this way, reality comes to be perceived as changing and changeable over the course of time [BASICS OF TIME].

This approach complements those sustainability strategies which study issues of justice [SUSTAINABILITY & JUSTICE] in particular because it stresses the aspects of time and the long term which, although they are essential to achieving sustainability, are at the same time especially hard to handle.

One essential feature of the stocks framework is that three different meanings of time are used [BASICS OF TIME] which, at first glance, may appear to have little in common with one another but which, when placed in relation to one another, open up new perspectives. When we look at stocks in nature and society we need to understand time, on the one hand, in the way we usually do, as an objective entity measurable in terms of seconds, years and centuries. We have named this conception of time *chronos*. We assume that

this conception of time is relevant when it comes to durable structures – *stocks* – and their dynamics.

Within the stocks framework, though, the ‘way things are’ appears at once as a limit to action as well as a space in which options for action exist. Therefore, in addition to the measurable time of *chronos* we also consider time in the sense of the ‘right moment’ or the right temporal structure for action – that is, as ‘time to do...’ something or as ‘time for...’ this or that action. The right time to act – which we call *kairos* – needs to be perceived by those called upon to act, and the opportunity to do so has to be grasped by someone who recognises it. Unlike *chronos*, this kind of time is not value-neutral, homogenous and quantitative in nature but rather qualitative: The right moment is, as it were, the window of opportunity which opens up at certain prominent points during the course of ordinary clock time – for those who look and are able to see it. This understanding of time is subjective because *kairos* depends on the purposes pursued by the person concerned.

We come to recognise *kairos* by looking at the third form of time, namely, the *inherent time* and *inherent dynamics* of stocks. By this we mean the typical dynamics and processes by which material and immaterial things around us develop and which therefore exert a powerful influence on our options for action. By setting our knowledge regarding the natural course of things alongside our awareness of the inertia of structures, with a little good fortune on the one hand and a practised eye for what is essential on the other, we are able to spot the early signs of an upcoming window of opportunity.

The stocks framework is a good way of creating an overview of diffuse situations so that the dimension of time can be viewed systematically. The aim is not so much to create new knowledge as to gain better access to existing knowledge and to make use of it. Working with the stocks framework may therefore often involve going back to existing, generally available sources of information whose knowledge is then integrated into an overall picture. Statistics and, above all, time series are important sources of this kind. They provide information about material stocks and their trends over time. In many cases it is also possible to derive information from them about immaterial stocks such as patterns of behaviour or preferences. Other important sources of information are the study of history – not only political history but above all economic, social, legal and environmental history. The history of institutions in particular offers important insights into both the inertia and the transformation of the broader setting in which action is taken. The stocks framework makes it possible to draw on so-called soft forms of knowledge – practical knowledge, experiences and intuition.

### Judgement and developing a 'sense of what is essential'

The possibilities for sustainable action in the face of the fundamental incompleteness of knowledge and human inadequacies are referred to in the context of our stocks framework in terms of the faculty of *judgement* [POWER OF JUDGEMENT]. Judgement is the human ability to place specific situations and general principles, rules or features in relation to one another. It is needed, on the one hand, to bridge the gap between the fundamental ethical requirements of sustainability and specific conditions for action. It also serves, on the other hand, to apply general knowledge to concrete states of affairs and situations. Judgement comprises the ability to define problems appropriately, to distinguish what is important from what is unimportant and what is conducive from what is misleading, and to integrate diverse elements into an overall picture. On top of this, one of the tasks of judgement is to perceive where there is a lack of knowledge and to deal with it in an appropriate way. It becomes apparent at this point that ignorance, or lack of knowledge, not only indicates the limited nature of our knowledge but also facilitates a certain open-endedness to our actions.

The role of the stocks framework is to provide guidelines for our faculty of judgement in respect of sustainability [SUSTAINABILITY & JUSTICE]. We have developed it into a guide for action – a heuristic – which is intended to help decision makers grasp sustainability problems in terms of their temporal dimension. The heuristic is intended to provide them with a degree of guidance on the complex terrain of sustainability policy and help them find paths leading towards successful policies.

### The art of long-term thinking

Given that the purpose of the stocks framework is to provide guidance for sustainable action, obviously it does not constitute a separate academic theory of nature and society aimed at illuminating any regularities or causalities in relation to sustainability. While the stocks framework regularly draws on the findings of such theories and feeds them into the overall picture of a given situation and its dynamics, it is not designed to contribute new insights to expert debates in these fields.

Even if the stocks framework is to be used as a heuristic, this does not mean that it can serve as a kind of recipe that can be followed without critical thought yet with the expectation of ending up with reliable practical solutions. Equally it cannot be used as a scientific instrument for conducting impact assessments. It is not a solution algorithm that could be used to programme a computer. Rather, the stocks framework constitutes a particular *perspective* on sustainability problems. It is intended to be attractive to decision

makers who are capable of handling it in a free and playful way. Perhaps the framework is best understood as a *lesson in long-term thinking*.

Anyone who has learned to work skilfully with the stocks perspective will acquire the ability to look at the world in a particular way – one in which the interplay of temporal structures in all the relevant spheres becomes visible and thus forms an overall picture. In the course of this, the stocks perspective proves particularly useful in enabling developments which are very probably *not* sustainable to be identified surprisingly quickly.

Viewed in this way, then, the stocks framework exists at the boundary between theory and practice. It takes everything from theory that is important in relation to a given sustainability problem and processes that knowledge and information in such a way that a kind of ‘information handout’ for practitioners emerges. As such it provides a basis for conceptualising sustainable action. What is taught above all in this ‘lesson in thinking’ is how to adopt a free and unencumbered perspective on the problem at hand and on the options for action. What is taught is not a science, then, so much as an *art* – a faculty that enables timely, sustainable action. This is *the art of long term thinking* (Klauer et al. 2017: 219-222).

## 4. Literature

The content of MINE originates from scientific work published in books and peer-reviewed journals. Quotes are indicated by a special typographic style.

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