Integrating Socially Constructed Scale into Theories of Institutional Change: Towards the Analysis of Institutional Re-Scaling of Social-Ecological Systems

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Abstract

The explorative paper in hand looks at the re-configuration of social-ecological systems. It is to provide ideas for the evaluation and explanation of the role of spatial scale in changing social ecological configurations and the processes and factors that socially construct spatial scales of jurisdictions. When we talk about institutional re-scaling of social-ecological systems we mean institutional change along spatial scales. However, as institutions themselves do not have a spatial scale we rather look at the way they are re-scaled across spatially defined jurisdictions. The paper has a twofold aim: a) to propose factors that potentially explain institutional re-scaling, i.e. the change of spatial level with which institutions are associated, including the social construction of scale. That way the paper aims b) to propose a pathway to evaluate hypotheses on institutional change along scale (re-scaling) derived from the literature, from theory and an illustrative case. The paper is inspired by the positive interest in the social construction of spatial scale that geographers hold. We aim at enhancing their understanding through adding new perspectives on social change derived from theories of institutional change. However in the limited scope of this paper we can do no more than opening up the discussion and developing first steps towards the realisation of the outlined agenda. The paper develops the argument as follows. First, different understandings of scale and re-scaling that geographers, ecologists, ecological economists, neoclassical economists and institutional economists associated with social-ecological research approaches hold are presented and evaluated. Second, a framework for analysing social-ecological interactions is introduced. Third, the spatial scale dimension of different categories proposed for analysing social-ecological interactions and the role of the spatial level of analysis is evaluated. Fourth, aspects of social-ecological re-scaling are evaluated for an illustrative case concerning the reconfiguration of water management in the Algarve, Portugal. Fifth, a set of categories for comparing theories of institutional change are developed. Finally, a research agenda is developed whose aim it is to develop a theory of institutional re-scaling in an iterative fashion.

Introduction

The explorative paper in hand aims to analyse the process of the re-configuration of social-ecological systems. “Ecological systems consist of interconnected biotic and abiotic components at a range of scales from microcosms to the entire biosphere. They are complex systems that exhibit a diversity of structural and functional characteristics“ (Costanza et al., 1996: 13). “Ecological systems play a fundamental role in supporting life on earth at all hierarchical scales. They form the life support system without which economic activity would not be possible… Ecological services are those ecosystems functions that are currently perceived to support and protect human activities or affect human well-being” (Barbier et al., 1994 quoted in Costanza et al., 1996). Ecosystems are part of what Hanna et al (1996) refer to as nature (a very contested concept in fact, see for example Macnaghten and Urry, 1998; Soper, 1995). “Nature that provides goods and services to people is transformed into a resource, particular to the respective time and culture. …..” (Hanna et al. 1996: 35ff.). Most natural resources are classified as common pool resources by economists, referring to two characteristics of their use. Ostrom et al. (1996: 129) write: “common pool resources are natural or human-made facilities or stocks that generate flows of usable resource units over time. They share two characteristics: (1) it is costly to develop institutions to exclude potential beneficiaries from them, and (2) at least one of the valued resource units obtained from a common-pool resource that are harvested by one individual are not available to others” (see also: Ostrom et al., 1994). They may be “renewable” sustaining a flow of resource units over a long period of time, such as water under most natural storage conditions, or they may be “non-renewable” (Berkes, 1996). Berkes writes that the common property literature emphasizes institutions as mediating factors that govern the relationship between a society and the natural resources on which it depends (e.g. Ostrom, 1990). They are important to include into the analysis of social-ecological systems as they describe essential feedback mechanisms. Institutions, such as property rights regimes, determine the way natural resources are managed. Similarly, Paavola et al. (2005: 355) argue that the combination of ecological and institutional economics “together achieve important intellectual developments by combining their insights on issues such as interdependence, complexity, resilience, scale, governance, and institutional design”.

Costanza et al. (2001; also Costanza et al, 1996) propose a framework for analysing ecosystems, human systems and their interaction composed by the concepts of stocks, and processes within human and social systems. Their interaction is described by stocks, flows, controls and their attributes. They write that in human systems, controls include physical and behavioural laws, selection mechanisms and rules in use, in other words, institutions. What is in- or excluded into the term institutions depends on its definition. It varies between perspectives of sociologists and economists following New Institutional Economics (see for example Vatn, 2005: 9ff). As definitions of institutions refer to different objects, respective theories of institutional change explain different phenomena. As a starting point we use a relatively broad definition by Scott who writes: “Institutions consist of cognitive, normative, and regulative structures and activities that provide stability and meaning to social behaviour. Institutions are transported by various carriers – cultures, structures, and routines – and they operate at multiple levels of jurisdiction” (Scott, 1995:33 quoted in Vatn, 2005).

The paper specifically aims at better understanding the drivers of spatial re-scaling of institutions which govern social-ecological systems. We understand spatial re-scaling

as a dimension of institutional change. The background is an increasing interest of social scientists from the fields of geography, ecological economics and social-ecological research in general in the concept of scale. The aim is to contribute to a theory of the social construction of scale from a broader perspective informed by approaches rooted in social-ecological systems research, ecological economics and various theories of institutions. Therefore, the paper is inspired by the ambition for a positive understanding of the social construction of scale as geographers hold it. We aim at enhancing this understanding from another perspective on social change. Concretely, we hope to complement prevalent normative theories on the question of scale in social-ecological systems principally associated with the views of economists and ecologists, with a positive theory of scale informed by theories of institutional change. Hence we want take Cumming et al.'s (2006) seriously, when they write that "the topic of scale is one of the themes that unifies different disciplinary perspectives". Throughout such an exercise its definition, on which we elaborate below, is crucial, as it distinguishes ecology from sociology (Turner et al., 2001). Admittedly, the outlined agenda is ambitious, complex and vast. Therefore, the paper in hand aims to do no more than opening up the discussion on its understanding and developing first steps towards its realisation.

The paper will develop the argument as follows. First, it will review the understanding of scale and re-scaling that geographers, ecologists, ecological economists, neoclassical economists and institutional economists associated with social-ecological research approaches hold. This work will provide the basis for our definition of scale and institutional re-scaling. Second the paper will introduce a framework for analysing social-ecological interactions. Third, it will elaborate on the spatial scale dimension of different categories proposed for analysing social-ecological interactions and on the role of the spatial level of analysis. Fourth, it will illustrate aspects of social-ecological re-scaling for an illustrative case concerning the reconfiguration of water management in the Algarve, Portugal, between the mid-seventies and today. Fifth, it will develop a set of categories for comparing theories of institutional change. Finally, we will translate the literature review, the illustrative case and the questions derived from categorising theories of institutional change into a research pathway whose aim it is to develop a theory of institutional re-scaling in an iterative fashion.

Review conceptualisations of scale

In what follows we provide a brief review of the treatment of scale and perspectives on re-scaling from the perspective of critical geographers, ecologists, ecological economists, and institutional economists working on social-ecological interactions.

In geography, concepts like "scale" or "rescaling" face a certain degree of elusiveness. Next to their function as heuristic or sensitizing concepts stand their explanatory ambiguity. The concept is broadly applicable and elusive at the same time. This makes it amenable to concept-stretching (Gualini, 2006: 895). As Marston (2000) writes, since the 1990s geographers with social theory interests have paid increasing attention to understanding the ways in which the production of scale is implicated in the production of space. They are specifically interested in the social construction of scale and its rejection as ontological given category. She writes that "[s]ocial theorists' attempts to address scale focus on understanding the processes that shape and constitute social practices at different levels of analysis" (Marston, 2000: 220). According to Howitt (2003) the dimensions of scale are size, level and relation, whereby he emphasises the latter as the former are too simplistic. Authors like Howitt furthermore contend that scale is "a relational element in a complex mix

that also includes space, place and environment – all of which interactively make the geographies we live in and study. … geographers, then, [have the] goal with respect to scale … to understand how particular scales become constituted and transformed in response to social-spatial dynamics" (Marston, 2000: 221). In agreement with Swyngedouw Howitt (2003) argues that scale practices need to be grasped through analysing empirical practices rather than theory. He finds it paradoxical that geographers try to theorize scale independent from geographical context (Howitt, 2003: 151).

Gualini (2006: 884) writes "the production of scale [is seen] as a dimension of socio-political agency". Scale is a contested arena whose hierarchical ordering is questioned. Agnew (1993) for example argued "against the reification of specific scales as distinct levels of analysis, but acknowledged that because different disciplines had come to specialize in analysis at different scale, integration had become more difficult. Rescaling processes are seen as "political" involving shifts in the relationships between state and society (Gualini, 2006:885). Theories of this process stress the centrality of state agency to resolve contradictions and crises in the territorial regulation of development processes (idem: 886). Marston (2000) argues that elements towards a theory on the (social) construction of scale seem to be bound up with globalization, the state, capital and nonstate-level political actors and their interactions. Re-scaling is also theorised as expression of social constructivist approaches. It assumes that social and political spaces have no given identity and that their representation is also always constitutive of their identity (Gualini, 2006: 892 quoting Massey, 2005). Then, re-scaling is "not so much .. the reordering of a pre-given articulation or hierarchy of scale, but rather the imagination and creation of new ones, through the promotion and enactment of context specific action rationales and modes of representation. … Scalar relations elude to a large extent the domain of competencies, influence and cognition of social actors. New "scales" of governance become involved in redefining the (spatial) rationale of regulation and the role played in it by state policies. "Rescaling", in this sense, is only partly understandable as the expression of the intentionality of specific institutional actors. It also depends on a capacity to mobilize and align local-regional forces through innovative inputs and incentives. The state articulations then become promoters, facilitators, enablers of new "horizontal" governance relations. State promoted "metagovernance" emerges intended as attempt at modifying the relative balance among various governance mechanisms and altering their relative importance (Jessop, 2002). It is constrained by high levels of institutional resilience. Therefore, policy experimentation obtains an important role as a means of institutional change.

Gualini (2006: 886) further highlights the connection between governance, which he sees as an experimental practice, and the redefinition of governance scales as a key component of this experimentation. Theorizing scale emerged from political and economic geography and state-theoretical governance studies. It therefore reflects a critical research attitude aimed at reinterpreting conditions for uneven and unjust development in post-Fordist "globalized" capitalism.

As we have seen in geography scale and the process of re-scaling are relatively elusive concepts that provide a broad lens for critical geographers with an inclination towards social theorizing to think about the implications of globalization for spatial governance, economic development and planning. Processes through which spatial scales and their interrelations to other scales are socially constructed are viewed as important components of the production of space, and therefore the production of our

physical environment. The analysis of state agency plays a crucial role in this process. Authors such as Brenner (2004) made the most important attempts to come towards a theory of spatial re-scaling.

In ecology, ecological economics, mainstream economics, institutional economics working on social-ecological systems, the concept of scale and therefore also the process of re-scaling takes on a different meaning. According to hierarchy theory ecologists perceive the natural world as hierarchy of scales divided by interaction minimizing boundaries (Costanza et al. 2001:7). They define scale in terms of the spatial and temporal dimensions of an object or process (Delcourt and Delcourt, 1998 quoted by Rykiel Jr., 1998). It is characterised by grain, the unit of spatial and temporal resolution, and extent, the spatial size and temporal duration (Turner and Gardner, 1991 quoted in Rykiel, 1998). Hierarchy does not necessarily imply a top-down relationship, but can also imply a dynamic, adaptive interrelation (see also: Holling et al., 1996: 78). According to Shurgart (1989: quoted in Costanza et al., 1996) the relationship between scales is given by natural patterns in environmental constraints, which contribute substantially to the spatial pattern and temporal dynamics of particular ecosystems. Within these levels of organization operations take place at one and the same scale (e.g. atoms, molecules, cells, organs, populations, ecosystems, bioregions, global system and beyond) (see also O'Neill et al., 1986 quoted in Hobbs, 1998:464).

In the context of ecosystem modelling associated with ecological economics, scale may refer to both, resolution (spatial, temporal, or degree of complication) and extent (in time, space, number of components) which can be measured. In such multi-scale systems the problem is aggregation (process of adding or otherwise combining components) and how to make larger units resemble smaller ones. Costanza et al. (1996) write that the hierarchical approach in ecology allows management of overall socially important ecological process or services they generate. It recognizes spatial and temporal scale interdependencies or cross-scale interactions.

Neoclassical microeconomics defines scale only implicitly. Scale is the level (quantity) of factor input measured on a continuous "scale", on which levels of input of factors of production can be ranked as higher or lower. So-called "economies of scale" (scalar increase in factor input) can either be increasing or decreasing, meaning that the output rises over- or underproportionally (Fritsch et al., 2005; Varian, 2003).

Another group of economists, institutional economists and political scientists working on social-ecological systems often emphasise the normative dilemma facing spatial development policy and planning (Gualini, 2006: 890). They postulate the redefinition of policies at specific scales of sociospatial structuration that is no more coincident with the spatial units defined by the institutional-administrative setup of the territorial state. In this context the re-scaling debate addresses issues of institutional misfit and the dynamics and contemporaneous multiplicity of sociospatial processes in a volatile, no more nationally self-contained economy. It involves differences in policy rationales that stress the adequacy of institutionalized forms of bargaining and social compromise in mediating between state structures and social interests. These approaches are developed against the background of a normative view on the relation of social and ecological scales (e. g. Cash, Folke, Lee, Young, Cumming et al. and Ostrom).

Cash et al. (2006) provide the most comprehensive treatment of the scale concept from their relatively open perspective on social-ecological systems. They define scale

as: “spatial, temporal, quantitative, or analytical dimensions used to measure and study any phenomenon”. They define “ “levels” as the units of analysis that are located at different positions on a scale”. Such levels can be spatial (area scale), temporal (time scale), jurisdictional (administrative scale), institutional (scale of rules), management (scale of plans), (social) networks (relational scale/ links) and knowledge (scale of validity of truths). Cash et al.’s understanding comprises that of ecological and classical economics and ecology. They include the (social) relational aspect that critical geographers stress, in their reference to jurisdictional, institutional, and network levels which inherently define specific scales. In our view the exactitude, which Cash et al. propose for describing scales is helpful for analytical purposes and coming towards a better theoretical description of what we term “re-scaling”. However, we contend that their types of scale are interrelated and in fact that further types of scale, such as the scale of technological networks or resources, are part of the “dynamics of re-scaling”. Furthermore, they fail to open their perspective up for the positive analysis of scale as an outcome of social, cultural, political and economic processes.

They analyse scale against a normative background of match or misfist between scales of social and ecological systems. Accordingly, they identify challenges that emerge from cross-scale and cross-level interactions[1]. Similarly, Lee (1993) contends that where “human responsibility does not match the spatial, temporal, or functional scale of natural phenomena, unsustainable use of resources is likely, and it will persist until mismatch of scales is cured” (Lee, 1993 quoted in Folke, 1998). The mentioned group of authors address the underlying question: how does scale relate to the ecosystem being managed and does it affect the effectiveness and robustness of institutions (Young, 2002; Folke et al, 1998, Hobbs, 1998). Similarly, Ostrom et al. (1996; Ostrom et al., 1994; Ostrom 2005) write that scale and cross-scale interaction matter for the functioning of institutions governing social ecological relations. Ostrom et al. (1996: 146) describe the advantages of locally devised (and run) system. Defending a similar normative stance they admit that spatial spill-overs are extremely difficult to address by such organisations and propose “to nest … organizations in a larger institutional environment that facilitates coordination among them, and that can address large scale problems that local level organizations share in common” as an alternative to “centralized management regimes” (Ostrom, 1991). Ostrom (2005) conceptualizes these social systems governing ecosystems as “holons”. She writes that “what is a whole system at one level is a part of a system at another” (Ostrom, 2005: 11). They can be analysed at almost any scale although theoretical concepts used do not necessarily scale up or down. Therefore, the institutional analyst has to learn the appropriate language to understand the respective focal level (Ostrom, 2005).

Young puts the same issue into a different question (2002): are large scale systems essentially macrocosms of small scale systems, so that it is a straightforward matter to scale up findings derived from the latter or vice versa. Ostrom negates this possibility. Her analysis focuses on action arenas which differ on different spatial scales. Young specifies that the number of actors involved varies, as well as the importance that key actors award to the relevant activity, and the relationships of power among them. Environmental problems emerge at different scales.

[1] Ignorance of interactions, mismatches between human and environmental systems at different scales and levels and the failure to recognize heterogeneity in the way actors perceive and value different scales. Problems can be multi-level or multi-scale, addressing more than one scale or level, or they can be cross level/ scale focusing on the interaction between scales/ levels (Cash et al., 2001).

Furthermore, he refers to a variation in “the strategic character of the problem or the structure of relationships among the major actors” which expresses different degrees of transparency (Young, 2002:140ff). Uncertainty of system’s behaviour varies across scale. The supply of an institutional solution to an environmental problem implies the provision of a public good, which implies free-rider behaviour. The question is how to provide and finance such public goods adequately and secure accountability. Again scale plays a role for evaluating different options in this regard.

Young (2002) provides more details on the variation of the characteristics of actors across scales. The forces that drive actors’ behaviour at different levels vary, their complexity varies, actors at different levels apply different “logics of action selection”, because of different contexts (e.g. logic of consequentiality or logic of appropriateness). Furthermore, the distance of those drafting from those enforcing or benefiting or loosing out from a legislation has implications for actors’ behaviour. Finally, Young points towards the social context, which varies from local to global context and which has important implications for actors’ interactions. With the above points Young addresses some of the issues that emerge from “re-scaling” an action arena across spatial scale. We contend that for developing a positive theory of institutional change across scale we need to evaluate these differences between scales as possible factors explaining re-scaling. We will therefore return to Ostrom’s and Young’s propositions in our concluding section.

Our focus with regards to re-scaling is the spatial scale. Different spatial scales are defined through levels, which have been “socially constructed” in practice and labelled. Different spatial scales are measured in units of area. They are furthermore perceived as an approximation of distance. We are interested in a positive understanding of the way the spatial scales of jurisdictions have been produced with which institutions are associated. Each spatial scale is interrelated with other scales: rule, administrative, temporal, analytical, management, ecological etc.. Therefore, by their nature or, given the complexity and multidimensionality of social ecological relations, each scale is contingently (property specific) embedded into a configuration of multi-, cross-scale, cross-level and intra-level relations.

Furthermore, the paper starts out from the idea that we do not know which are the decisive elements/ scales and levels that determine the performance of social-ecological systems. A variety of analytical frameworks conceptualised social-ecological systems making proposals about which may be the decisive elements in social-ecological systems (e.g. Hagedorn et al., 2002; Vatn, 2005; Ostrom, 1998). We contend that scale is notoriously underemphasised in these frameworks as we see it as a key dimension of institutional change. The frameworks we refer to have been developed by institutional economists which analyse social-ecological systems. In contrast to the critical geographers we referred to above, institutional economists focus less on the analysis of macro structures (also associated with holism, Hodgson, 2004). Their approaches vary between methodological individualism, which “implies a position where all social phenomena can be explained on the basis of individual behaviour and individual purpose is the source of all action” (Vatn, 2005: 48) and methodological holism, “where social phenomena can only be explained by reference to other social phenomena” (idem: 48). In order to escape the valid criticisms of both and overcome the underlying issue of stressing either structure or agency, Vatn (2005) suggests to develop what he calls methodological institutionalism “to describe a methodology which focuses on the dialectic process between agents and structures” (Vatn, 2005: 54). It combines intentional and causal explanations. Similarly, Paavola et al (2005) admit the need to abandon methodological

individualism in favour of explanations that include reasons as well as causes, which are rooted in the structures into which individuals are embedded. Nonetheless, we would argue that the analysis of the actions of individual agents and their conception always plays a more prominent role in the approaches of institutional economists than in the approaches of the critical geographers. Hodgson criticizes the latter, associated with critical realism or Marxism for not explaining the evolution of reasons and beliefs. On the other hand he recognizes their strength to account for the powerful role of social structures over individuals, while they at the same time retain the concept of agency. When the paper turns to theories later on, we will not pronounce a preference on theories associated with either structuralist or voluntarist conceptions, which search explanations in structures or individuals. In contrast, we argue that such a pronouncement is better made on the basis of case specific, empirical evidence.

The only authors we found that strive towards a positive explanation of administrative scales and the allocation of competencies to jurisdictions are Hooghe and Marks (2001). They distinguish two types of governance. As type I governance they describe federalism: “power sharing among a limited number of governments operating at just a few levels”. Jurisdictions in Type II governance are task specific, territorially overlapping, and numerous. Many jurisdictional levels exist and the overall system is flexible. Subsequently, these authors “locate” these two types of governance. Type I resembles European federal and unitary states. Type II appears in the niches, or at the edges of Type I governance (the public/ private frontier, the national international frontier, densely populated frontier regions of bordering states). They explain their co-existence as follow: a) they conceptualise it as efficient responses to problems of inter-jurisdictional coordination. Type I governance are limiting costs of coordination. Type II governance limits spill overs between jurisdictions by compartmentalising. b) Path dependence has important impacts and costs of institutional change explain the emerging structure. Decisional barriers are often high specifically with regards to change of Type I governance. Territorial identity similarly contributes to the maintenance of existing governance structures. A more comprehensive theory on institutional re-scaling based on theories of institutional change will have to take these factors into account.

In the following we want to illustrate where spatial scale may play a role in social-ecological interactions. For this purpose we chose to explore scale through the perspective of the analytical framework Institutions of Sustainability (IoS).

An analytical framework of social-ecological interactions – the IoS framework

The purpose of a framework like the IoS is to “bound inquiry and direct the attention of the analyst to critical features of the social and physical landscape. …..” (Schlager, 1999: 234). It does not imply stable, "theory-like" relationships between the categories it singles out. The IoS framework has been developed for the analysis of agri-environmental practices[2]. It considers “features of transactions and properties of actors …as determinants of institutional innovation leading to property rights on ecosystem functions and governance structures for natural resources” (Hagedorn, 2005: 7). Contextual elements are, for example, the social embeddedness of the

[2] For Hagedorn (2005: 14) they feature “actor and resource characteristics …[where] … different (positive and negative) effects do not accrue to the same group,…. The resource or the environmental medium often has no clear boundaries and positive (intended) effects and negative (non-intended, side) effects materialise in different environmental media and different geographical areas”.

elements, the dynamic view of institutional change, the level of analysis and the institutional links between these elements.

Transactions, as we define them here, occur where a good or a service is transported across a technically separable interface. This definition by Williamson (1985:1) has been coined on the basis of the analysis of processes of industrial production, where the process of production can be divided up into technically separable steps of production. Their coordination is necessary to produce the desired end-product. In social ecological systems, we would argue, it is sometimes less evident how to technically separate the "steps involved into the production" of goods and services (or bads and disservices) that emerge from social ecological interactions. In fact, often the problem is that certain groups of goods and services (bads and disservices) are necessarily produced jointly by social-ecological interactions. They are technically hardly separable and therefore the coordination problem that emerges from social ecological transactions has distinct properties than the coordination problem that organisation of industrial production is faced with. In the case of social-ecological interactions we would argue that, presuming a normative perspective, the need for coordination is inseparably bound with the transaction whereas in the case of industrial organisation coordination is the precondition for the occurrence of a transaction. Gatzweiler and Hagedorn (2002: 54) define transactions as "exchange relationships of material assets … between actors of the social system and the ecological system". They produce environmental problems through production or consumption. They are the central unit of analysis in the framework we propose (see also: Beckmann, 2002). In relation to the characteristics of a specific transaction[3], property rights and governance structure and the characteristics of the actors involved have to be analysed.

Actors relate to each other through transactions which are mediated by two types of formal or informal institutions. Governance structures stand for structures that supervise and sanction property rights to specific 'components of nature' (e.g. different aspects of water quality) or that organise transactions. They relate to formal property rights and include plans, licensing regimes or legal rules, and the structures and entities striving to implement them. Governance is contingently and dialectically interrelated with the other elements (features of transactions, actors, and property rights).

Property rights distribute cost and benefit streams from transactions. They can be attributed to goods and services provided by agri-environmental or social ecological systems (Gatzweiler and Hagedorn, 2002: 41). Hagedorn (2005) specifies that property rights are attributed to components of nature, not least because our knowledge of the interrelations which characterize ecosystems is necessarily partial.

[3] Properties of transactions: rivalry, excludability, asset specificity, separability (the opposite of jointness in production), frequency of transaction, uncertainty in demand and supply of the good provided, complexity of the causal relationship with the ecological system (and knowledge dependence), heterogeneity and variability of attributes of many environmental problems. Technological and structural changes alter these properties (Hagedorn et al., 2002). More details on the attributes of the categories used by the IoS framework are provided elsewhere (Hagedorn et al., 2002; Hagedorn, 2005; Gatzweiler and Hagedorn, 2002).
The characteristics of actors: values and beliefs and attitudes and perceptions, reputation (reliability and credibility), resources in relation to their interaction with the ecosystem, and resources for influencing political decision making at the various levels, access to information and knowledge and capacity to process and retain it, actor's method of action selection (Ostrom 1998, p70, quoted by Hagedorn et al. 2002 p11) or assumption about what mode of calculation determines an actor's behaviour (bounded rationality, rationality or learning) (idem, p10-12). We also include normative legitimacy (in relation to attitudes instead of formal norms). Characteristics are influenced by the transaction, as actors are able to learn from experience.

For example, property in land is not 'total' but only gives an entitlement to use land in certain ways. Unaccounted for consequences (externalities) are bound to happen. The maintenance of property rights to components of nature implies transaction costs[4]. They depend on the characteristics of the transaction, the 'splitting' of property rights (partial or not) regarding components of nature, as well as their allocation either at a central or decentral level[5] (Hagedorn et al., 2002). For a graphical representation of the IoS please see Figure 1.

Introducing spatial scale into the IoS

Showing a pathway towards better understanding re-scaling [of institutions] in [changes of] social-ecological configurations is the aim of the paper. The IoS singles out transactions, property rights, actors and governance structures for analysing social ecological interactions. In this section we evaluate the spatial dimensions of these analytical categories. For most categories we will be able to point towards a specific aspect of the analytical category that has a spatial dimension.

In order to avoid misunderstandings one last points needs clarification with regards to our perception of scale. We consider the spatial dimensions of the specific analytical categories that the IoS suggests as opposed to the question if the scale of analysis matters to the assessment of the specific analytical category. To give an example, we wonder if transactions have a spatial property as opposed to if our description of transactions depends on the spatial scale at which we analyze them. We are therefore interested in the spatial properties of the analytical categories rather than in the difference that the scale of analysis makes. Nonetheless, we will also refer to the role of the spatial level of analysis with regards to each category.

Above we specified that we are specifically interested in the spatial scale of the analytical categories of social-ecological interactions, as opposed to the temporal, administrative, knowledge scale or the like. Spatial scales that are defined in area or distance operate on different levels of the respective scale. Different scales are defined through or referred to as levels, which have been "socially constructed" and labelled. They are not ontologically given but they are constructed through social practices such as material exchange or mental, discursive, analytical framing.

Transactions and spatial scale

Transactions, as we define them here, occur where a good or a service is transported across a technically separable interface necessarily creating a coordination problem.

Social-ecological transactions have a spatial scale we would argue. In essence transactions are coordination problems. Depending on the characteristics of the physical resources that interconnect people's utility materially and on the spatial configuration of people on which a transaction impinges, the coordination of people's interaction takes place on specific spatial levels. For example, the spatial level of the coordination problem differs if a transaction implies visual impacts than if its

[4] Transactions necessarily have implications for property rights of others. Coordinating property rights imply "costs of running the economic system" (Arrow 1969: 48, quoted in Williamson 1991: 269) or transaction costs. Challen (2000: 28) writes "transaction costs are the costs incurred in organising and coordinating human interaction". Borrowing from Coase (1960: 15), he details: "the costs to discover who one wants to deal with, to inform them about the wish to deal with them, the terms on which one wants to deal with them, the costs of negotiating with them, drawing up a contract and monitoring it etc.". In several texts Williamson therefore equates transaction costs with governance costs, which depend on the form of governance (see e.g. Williamson 1998, 1991).

[5] Specialisation - high transaction costs - central allocation; bundling property rights - low transaction costs - decentral allocation

predominant effects are transported to more distant actors that are encompassed by a larger area unit, as in the case of media such as water or air.

The IoS proposes several analytical subcategories pointing to specific aspects of transactions. They do not have a spatial dimension. Probably this should not surprise us as we started out from the perception that the analysis of social-ecological interactions traditionally pays little attention to the role of spatial scales. Therefore, we propose to include spatial scale as a further dimension to characterise transactions, in addition to those referred to by Hagedorn et al.. Originally these authors refer to rivalry, excludability, jointness or separability, complexity, heterogeneity, uncertainty, asset specificity and frequency. Specifically, rivalry (also associated with degree of substitutability), excludability, complexity, asset specificity (degree of potential to use for alternative purposes) of a specific transaction vary with the spatial scale of analysis, we would argue. In contrast, uncertainty and frequency do not vary with the spatial level of analysis of a specific property.

We want to expand the list of properties of transactions that Hagedorn et al. propose in order to do justice to the role of scale in social-ecological interactions. Specifically, we argue in favour of the consideration of two further analytical categories. a) We suggest the inclusion of the scale into the analysis at which the resource interconnects actors. For example, we argue that the scale of the water body that is implicated into a transaction matters to the way the social ecological interaction is carried out. I. e. it matters if we look at a small scale aquifer, a large scale aquifer, a small local river or a large one, possibly of transboundary, supranational scale. This way the obvious case of spatial match or mismatch between the scale of transactions and the scale of the institutions governing them comes into focus. b) We argue that the scale of the technology that causes the coordination problem needs to be included into the analysis of transactions. Often different technologies can be used to provide a service. For example, water can be provided by drilling a well, building a dam or transferring water across basins. Such different technologies imply coordination problems (or effects) concerning actors at different spatial scales. We argue that the scale of transactions, co-determined by the technology of exploitation and the spatial extent of the interconnection of actors can play a significant role for the shape of social-ecological interactions. So far insufficient attention has been paid to both dimensions of transactions. Nonetheless, we argue that they play a vital role for understanding the social construction of the spatial scale at which institutions operate that are involved in social ecological systems.

Actors and spatial scale

Several properties of actors have an important spatial dimension. Specifically, the resources of collective and specifically public-administrative actors are defined by the boundaries of a jurisdiction. Because of their specific spatial expression at this point we want to describe the connections between spatial and administrative scales. According to Cash et al. levels on an administrative scale are jurisdictions, which may be sector, function, or area specific. A jurisdiction defines legitimate exercise of powers within institutionally defined, spatial and functional boundaries. Where jurisdictions are area specific (i.e. their unit of application is spatially defined), they have a spatial scale over which the jurisdiction operates according to the institutional configuration in which they are embedded. We would argue that many jurisdictions are configured in a defined space through rights and duties (competencies) applicable to transactions. Consequently, jurisdictions are institutionally *and* spatially bound. They often have a spatial label, such as regional, metropolitan, cross-regional, local, national, coastal. Each of these labels refers to a territorial/spatial unit

which defines the area over which the jurisdiction's institutional configuration is homogenously valid. In the context of these considerations we figure that institutional configurations associated with levels on an administrative scale, often have a spatial scale. Accordingly, for example, public administrative actors' physical resources have a spatial scale defined by the boundaries of the jurisdiction. Similarly, to the extent political power influences the exercise of powers of a spatially defined jurisdiction, political power can develop a spatial dimension. With regards to powers we emphasise that actors' physical power has a spatial dimension, as in the case of the jurisdiction of local authorities or that they politically influence the exercise of spatially bound powers. Therefore, physical as well as political resources of actors may have a spatial dimension that may be involved into the social construction of spatio-institutional scales.

Moreover, we argue that actors' values, beliefs and "mental models"[6], which are immaterial constructs, nonetheless have an element of spatial scale. They provide the frame of analysis of social ecological interrelations (see also: Denzau and North, 1993). As they relate to a specific spatial scale, they influence the perception/ analysis of a transaction. Comments on the levels of analysis matter in this respect.

Finally, we argue that embeddedness into the social environment has a spatial scale. We define that changes along the scale of embeddedness are characterised by changes in the quality of social relations. In order to define it we run into the problem of distinguishing degrees of embeddedness/ quality of social relations in a meaningful way. However, in this paper we do not want to elaborate further on problems inherent in operationalising a scale of embeddedness but we want to assume its feasibility. As spatial scale of social embeddedness we refer to distance between (socially embedded) actors or the spatial unit in which they are encompassed. We argue therefore that the spatial scale of embeddedness of actors matters to the quality of social embeddedness and its consequences. Embeddedness at the local level is distinct from embeddedness at a higher level. Its implications matter probably not least in relation to the spatial properties of the resource and the technology by which it is exploited.

For example, credibility of an actor and the perception of legitimacy of its actions, we argue, are intertwined with its social embeddedness. Furthermore, issues such as experience of mutual exchange, which may lead to trust, which can be analysed through categories such as social capital, play a role in this respect. The emergence, potential and existence of credibility, legitimacy and the degree of social embeddedness vary with the spatial scale across which actors transact.

Actors' logic of action selection is similarly bound with its organisational context. Nevertheless, it would be too far-fetched to argue for a spatial dimension of the logic of action selection, or for a spatial dimension of capacities for acquiring and processing, retaining and using knowledge.

In contrast to the properties of transactions very few properties of actors vary with the spatial scale at which they are analysed. Social embeddedness, logic of action selection, political and physical resources, values and belief systems and actors' intellectual capacities and the perception of legitimacy of transactions do not vary

[6]For Denzau and North (1993) "Mental models" provide both an interpretation of the environment and a prescription as to how that environment should be structured. Mental models are the internal representations that individual cognitive systems create to interpret the environment and the institutions are the external (to the mind) mechanisms individuals create to structure and order the environment (Denzau and North, 1993). Some types of mental models are shared intersubjectively.

with the spatial scale of analysis. On the other hand legitimacy as the perception of legitimacy of transactions varies with the spatial level of analysis and the corresponding spatial analytical level at which actors in general and those actors determining the legitimacy of actions analyse the problem.

Institutions and spatial scale

Besides transactions and actors the IoS proposes to analyse two categories of institutions to conceptualise social ecological interactions. On the one hand it refers to property rights, which define the cost and benefit streams from transactions, whereby costs and benefits need to be understood in a broad sense. On the other hand it refers to governance structures, which enforce property rights and organise transactions.

Property rights

We argue that property rights as well as governance structures do not have a spatial scale. Nevertheless, both are bound up with jurisdictions, which, as described above, often have a spatial dimension. Specifically formal governance structures and property rights therefore have an indirect spatial dimension which is defined by the extent of the area in which they are homogenously valid. Property rights, hierarchical, market or hybrid modes of organisation have a spatial scale defined through the spatial extent across which they are homogenously valid. In other words, we argue that it matters for specific social-ecological interactions which extent the area has, for which formal and informal institutions are valid. Concerning property rights the spatial scale at which they are defined may have implications for the way cost and benefit streams are distributed. In our setting property rights relate to components of nature, which are, among others, spatially interrelated to other components of nature. Therefore, we would argue that property rights distribute cost and benefit streams of transactions across spatial scales. The effects property rights distribute depend on the transaction, the way they distribute these effects depends on the specific formulation of property rights.

Governance structures

Concerning governance structures we argue that the spatial extent of the area across which they are valid matters to the way transactions are organised/ sanctioned. Governance structures do not have a spatial scale but they are associated with jurisdictions that have a spatial scale. This seems to be specifically plausible when we refer to a broad perception of governance structures, as defended in the IoS. It includes knowledge and information systems (measuring and monitoring systems), constraining and enabling mechanisms (e. g. incentives and opportunities), and rules and procedures for conflict resolution. For example, it could be expected that governance structures and institutions associated with a lower jurisdiction (lower level of spatial extent) are in general more case sensitive and therefore potentially better performing on a variety of criteria than higher level institutions (see for example Ostrom, 2005 on criteria for institutional design). Moreover, changes in relations within and among scales and levels are an inherent part of re-scaling.

For institutions such as property rights and governance structures spatial scale is only an indirect dimension through their association with a spatially defined jurisdiction. The spatial level of analysis matters specifically to the analysis of property rights. The variation of the spatial scale of analysis, we argue, leads to either in- or exclusion of costs and benefit streams into the analysis. On the other hand, we

argue that the spatial scale of analysis does not seem to affect the analysis of governance structures and their performance.

Case illustration – institutional re-scaling of water management in the Algarve, Portugal

The last, principal section of the paper elaborated our understanding of scale in social-ecological interactions. The underlying idea was that, in order to explain scale, we need to understand which aspects of social ecological interactions are structured by it. In this section we want to illustrate our understanding with reference to a case study. The case illustration we refer to deals with the changing social-ecological interactions shaping water management in the Algarve, Portugal between the mid seventies and today. We described it extensively elsewhere (Thiel, 2005, 2006, 2008). In this subsequent account we emphasise the changes in social-ecological interactions with reference to the analytical categories proposed by the IoS. We emphasise changes in the dimension of spatial scale.

Background of social-ecological restructuring

The re-configuration of the social-ecological interactions implied in water service provision developed before the background of structural changes in the sectors demanding water and their spatial distribution. In the mid seventies as well as today water was provided to agriculture, local residents and the tourism sector. Today the same sectors receive water. However, the relative and absolute significance of the tourism sector and associated irrigation for the maintenance of green spaces and golf courses increased dramatically. Coverage with piped water increased to almost 100% and the quality of drinking water provided improved significantly. Although precise figures are missing, we assume that overall water consumption increased as because besides the relative increase in demands by the tourism sector, also agricultural and residential uses increased. Furthermore, tourism development and golf courses on the coast restructured the spatial configuration of water demands.

Transactions and re-scaling

The illustrative case looks at *transactions* involved into the abstraction of water for residential and temporary populations and/or for agriculture from underground and surface waters. In the following we will go through the various analytical categories describing changes between the situation in the mid seventies and today. On the supply side two transactions are involved into water provision at both moments in time: abstraction from aquifers and abstraction from surface waters. However, their relative importance as well as the technological system recurred to for exploitation changed.

Abstraction from aquifers in the mid seventies and today are excludable, rival, asset specific, separable to a similar degree. However, besides exploitation of individual wells, today substantial demands are satisfied by a network of pipes and water treatment plants that interconnect several wells and all surface waters on the supralocal scale of the overall district. Water supply to the tourism sector and residents from this network is metered. Therefore, operational costs of exclusion were lowered while possibilities and costs to avoid that individual users drilled wells legally or illegally probably remained roughly the same.

Due to the physical interconnection of aquifers and surface waters on a supralocal level, we would further argue that substitutability of sources increased and asset specificity potentially decreased. Hence we argue that in cases where the spatial level of (technologically induced) interconnectedness of a resource shifted also the

level of analysis of the transactions involved needs to be shifted. The scale of the resource system implicated in water service provision increased due to the supralocal scale at which underground and surface water resources are interconnected by technologies. In consequence, we would further argue that the complexity, uncertainty, heterogeneity of the effects of transactions involving the interconnected water supply infrastructure increased. Finally, it seems that legitimacy of transactions is disputed to a greater extent by the now competent regional administration on the grounds of formal property rights regulations which did not exist before. Furthermore,

Actors and re-scaling

Actors involved in water management in the Algarve changed. Formerly, local users (municipalities, farmers, residents, tourism enterprises) were largely uncontrolled in developing resource use within the boundaries of their respective jurisdictions.

Nowadays, individual water abstraction needs to be licensed by the supra-local water authority. The largest amount of water is provided by the interconnected water supply system which is run by a supralocal water company in national public ownership. The scheme has been designed and implemented by the national water administration. It either provides water directly to users or it channels it through municipal water distribution infrastructures.

With this changing set of actors, properties of actors varied significantly. We would argue that the scale of the mental model (as well as respective values and beliefs) of water service provision in the Algarve that significant "executing actors"[7] hold, changed, not least as their respective level of analysis changed. Furthermore, besides increasing physical resources the new set of executing supra-local and national actors hold physical and political powers that are associated with the supra-local jurisdictions providing homogenous powers across the overall region. We would argue that, among other factors such as educational background, this extended the spatial scale of homogenous executive powers[8] influenced (or even "selected") the scale of the mental model and level of analysis that executive actors hold. A technological system interconnecting the resources was constructed as best solution feasible by up-scaled powers.

Moreover, executive actors nowadays hold much greater data, data gathering and processing capacities than in the beginning of the seventies. Furthermore, executive actors at the supra-local, regional and national scale are embedded into social relations that extend across various administrative scales and the associated homogenous spatio-institutional configurations. In other words, they are embedded into networks linking up water management experience extending from the specific, local, Algarvian level to the European level and beyond. In contrast, in the mid seventies, executive actors were predominantly embedded at the local level. Again we assume that executive actors' mental models, credibility and behaviour (also: logic of action selection) varied in response to this context variation because of a shift in the spatial scale of social embeddedness.

Institutions and re-scaling

Surface water remained *public property* and groundwater remained private property since the mid seventies. Nonetheless, licensing regimes covering various aspects of water use, which did not exist before, have been introduced to formally constrain the

[7] Actors that hold the political, financial and regulatory capacities to bring about water supply.
[8] See footnote 7

exercise of private property rights to groundwater. Groundwater as well as surface water exploitation furthermore became subject to constraints formulated in environmental impact assessments and integrated river basin planning. Prices for water consumption charged to the tourism and residential sectors increased. The respective changes in property rights re-distribute cost and benefit streams (rights and duties) of transactions involving the exploitation of water. The ecosystematic characteristics of the resource and the spatial distribution of actors indirectly define the spatial scale at which actors experience changes in property rights. Nonetheless, spatial scale is no dimension of property rights themselves. Today, actors engaged in the technical exploitation of water are compensated to a large degree monetarily by those benefiting from water service provision. This concerns actors at the local, supralocal and national level. Furthermore, constraints have been formulated on those exploiting water to compensate for or respect non-commodified services of water, such as their contribution to intact ecosystems. The scale that encompasses actors benefiting from the latter goods is elusive as, in theory at least, it is impossible to exclude from their benefits.

Neither property rights nor governance structures have a spatial dimension. Nonetheless, changes in *governance structures* similarly have an indirect spatial scale. Often they are associated with the spatial scale of a jurisdiction. In the case study the structures sanctioning, supervising and organising transactions with regards to the use of water have changed. De facto, in the mid seventies only water provision from aquifers was possible. It was governed by an open access regime with access restricted to those that held land above aquifers. We argue that it was quasi open access as, despite access restrictions to land title holders, coordination among those that held the land title was inexistent. Therefore, governance structures were limited to the enforcement of land titles. Governance failure regarding water resided with the local level as only level which at the time had competencies to constrain water exploitation through charges.

Nowadays, extensive governance structures coordinate/organise the use of water through sanctioning and supervisory structures. “Executive actors” that provide for water or procure their own water are subject to hierarchical regimes that define options to provide water through plans, quota and administrative procedures (e.g. EIA). Users that receive water through municipal or supra-local infrastructures coordinate their use through a market regime with a supply monopoly. This regime may be replaced by a hierarchical regime of quota during periods of extreme water scarcity. In the mid seventies absence of governance structures covered the entire Algarve. Today, water exploitation and provision are covered by a governance structure that coordinates water abstraction through licensing and planning. This institutional regime applies homogenously at the scale of the entire Algarve. The hierarchical planning and quota regime as well as the market regime are associated with actors whose jurisdiction extends across the spatial scale of the entire Algarve.

Summary

In the described case illustration re-scaling of social-ecological interactions could be observed for various analytical categories. Referring to the categorisations the IoS proposes several aspects describing transactions were spatially up-scaled. The scale of the resource exploited increased as well as the scale at which the technology to exploit the resource operates and interconnects the resource base. In consequence, analyzed at a greater scale of physical interconnections we argued that complexity, heterogeneity and uncertainty increased and specific units of water resources

became more substitutable and investments into exploitation of water resources became less asset specific.

Actors' mental models and spatial levels of analysis changed not least as executive actors are associated with jurisdictions whose spatial extent increased from the local to the supra-local and national level. Furthermore, the spatial scale of physical powers of executive actors shifted to the supra-local level and the spatial extent of the relevant social relations shifted from a local to a multi-jurisdictional embeddedness, whereby we excluded a closer characterisation of the quality of social relations involved in embeddedness.

With regards to property rights we argued that costs and benefits from water exploitation have been (spatially) redistributed through re-scaling. Institutional re-scaling to the supra-level implied the institutional and physical homogenisation of water management and provision in the Algarve. It allowed for redistribution of water from water rich interior localities to water poor coastal localities. Quasi in return, water infrastructures in financially poor localities in the interior received cross-subsidied. This redistribution is determined by the spatial configuration of the resource, demands on the resource and actors.

Governance structures have changed significantly and become more differentiated combining hierarchical and market organisation for the coordination of water use. While previously their de facto absence was characteristic for almost the entire Algarve, now they are homogenously valid at the same scale. Governance failure previously occurred principally at the local level, which was the only level that had the competence to constrain water use through charges. Coordination, previewed at the regional level was absent. Today the supervision, sanction and organisation of transaction is principally determined by the supralocal level and supervised by the national level.

At first sight it seems that the supralocal technological interconnection of surface and underground water resources seems to be a response to the constitution of powers, governance and institutions at the supralocal level by re-enforced capacities at the national level. The national level extended its grips over water resource management by re-scaling water management physically and institutionally. Initially, after the revolution, in 1973, they were the competence of local authorities.

We argued above that institutions, i.e. property rights and governance structures themselves do not have a spatial scale. Nevertheless, they are associated with jurisdictions many of which have a spatial scale. Our interest in institutional re-scaling aims to explain a shift in jurisdictions with which institutions are associated. Obviously, determinants may be changes in scale of aspects of other elements structuring social ecological interactions, such as transactions and actors.

The described illustrative case would suggest hypothesising about the role of an upscaling of technology, resources exploited, physical and political powers, mental models, levels of analysis or social embeddedness of actors. However, upscaling of institutions does not necessarily need to be linked to aspects of upscaling of transactions and actors. In order to evaluate how theories of institutional change would explain re-scaling we will outline further steps of analysis in the next and the concluding section. Beyond the scope of this paper these further steps of analysis and iterative theory development are supposed to show a pathway towards a theory of institutional re-scaling. Because of the limited space in this paper we intend to only spell out the details of the possible contribution of theories of institutional change for

explaining institutional re-scaling, as a subcategory of institutional change, in future work.

Theories of institutional change and their categorisation

This paper starts out from the idea that institutional change may have distinct characteristics depending on the dimensions changed and that the evaluation of theories of institutional change regarding a specific dimension may be fruitful. Alternative dimensions of institutional change may be the horizontal reconfiguration of institutions into jurisdictions configured by different institutions, or their "degree of formality". This section aims to develop a pathway towards theorizing institutional change across scales of jurisdiction (re-scaling).

Methodologically, different theories of institutional change investigate and explain change relying on different conceptions of the roles of structure and agency for social change. Hodgson writes that new institutional economists explain institutional change through the intentions of individuals (see also Vatn, 2005 and Richter and Furubotn, 1999). On the other hand, in order to explain the origin, development and co-evolution of institutions and individuals Hodgson discusses the role of methodological collectivism, where "all individual intentions or behaviour should be explained entirely in terms of social, structural, cultural or institutional phenomena" (Hodgson, 2004: 23). However, he subsequently criticizes both, methodological individualism and collectivism saying that "[f]or both there seems to be no adequate explanation of how social institutions may reconstitute individual purposes and preferences and both disregard psychology in the explanation of social phenomena". Alternatively, Vatn (2005:54) proposes "methodological institutionalism [which] accepts that phenomena exist independent of individuals [but where] in relation to explaining change in social structures, agents must play an important role" (idem: 54).

New institutional economics identifies itself with methodological individualism, while structuralist theories such as those in the Marxist tradition methodologically search for explanation in collectives. In contrast sociological or evolutionary theories of institutional change or the theory of institutional change developed by North (1994) seem to best fulfil the postulates of methodological institutionalism situated in between the explanatory approaches of methodological individualism and collectivism. However, depending on the specific case, emphasis can shift from the way institutions shape human choice to the way humans shape institutions (Vatn, 2005). Furthermore, for Hodgson, it needs to be explained how institutions constitute individual purposes and preferences and what role psychology plays in this. Hodgson's and Vatn's discussions situate theories of institutional change close to ongoing, more general debates in the social sciences on the mutual interactions between structure and agency (see for example: Hay and Jessop, 1992; Hay, 2002; Giddens, 1984; Archer, 1995; Hay, 1995; Hodgson, 2004; Jessop, 2001).

Theories of institutions and institutional change pronounce themselves differently on the role of institutions and agents, their preferences and purposes in institutional change. The pathway we want to develop towards a theory of institutional re-scaling is to provide the steps for evaluating existing theories of institutional change with regards to their potential to explain institutional re-scaling. In this section we briefly describe categories through which theories of institutional change can be classified, clustered and compared and illustrate this categorization. We will indicate questions for empirical analysis in order to clarify how we will select/ evaluate potential theories of institutional re-scaling. Finally, we suggest elements of a study project for

iteratively developing and testing theory development regarding institutional re-scaling.

A variety of contributions categorizes, reviews and compares theories of institutional change (Schlüter, 2003; Cumming et al., 2006; Schmid, 2004; Vatn, 2005; Allio et al., 1997). However, among these categories overlaps are common-place. First of all we want to clarify that we want to theorise institutional change as opposed to institutional emergence. Indeed, in practice the two can only be distinguished through somewhat artificial, definitional "manipulations". Second, the object of the theory of institutional change has to be clarified. Theoretical traditions *define institutions* differently. To name two extremes, New Institutional Economics conceptualise institutions as exogenous to actors, as constraints on action and instruments that provide certainty and make transactions predictable (Richter and Furubotn, 1999: 39). At the other extreme sociological institutionalists include routines and habits which have been internalised by actors under the definition of institutions (Berger and Luckmann, 1986; Powell and DiMaggio, 1991). With reference to the way in which institutions are fixed and communicated we can further distinguish between *formal and informal institutions*. Lin (1989) conceptualises formal institutions as collective goods whose provision is subject to free rider behaviour. In contrast, informal institutions are private goods. In other words, formal institutions are codified by a collective and apply to the overall collective, no matter who produced them. They are backed by its formal sanctioning mechanisms whereas informal institutions are negotiated and enforced decentrally among individuals.

Furthermore, Schlüter (2003) distinguishes *political and economic institutions* and their change. He writes that economic institutions develop decentrally through the interaction of several actors. Political institutions are agreed upon through the political process and subsequently formalised as laws. We perceive this categorization as too schematic as process of emergence/institutional and outcome cannot be as clearly distinguished as Schlüter suggests. Furthermore, we can distinguish between theories of intended or unintended institutional change. The latter can further be categorized into theories of designed institutional change (Vatn, 2005) which may be imposed by the government or deliberately induced due to profitable opportunities of the institutional entrepreneur (Lin, 1989) and theories of spontaneous institutional change which emerges as decentral adaptation mechanism where institutional change provides win-win situations for actors (Vatn, 2005). The latter set of categorisations moves towards distinguishing between institutions on the basis of the mechanisms that produce institutional change. In this regard it is important to distinguish the *conceptualisation of the agents of institutional change* (North, 1994). Significant in this respect is the question if actors hold stable preferences, if we assume them to be rational or boundedly rational (Schlüter, 2003 and North, 1994) and what role endogenous "institutions" such as routines, habits and mental models play for their involvement into institutional change.

For describing *mechanisms of institutional change* (Allio et al., 1997) North (1994) distinguishes sources and processes of institutional change. We would argue that sources of institutional change can be exogenous to actors (for decentral, induced change: changes in (known) institutional choice sets, technology, long run relative factor and product prices or other institutional arrangements; for government imposed change: perceived institutional "disequilibria" where costs of institutional change to the government are lower than expected benefits, or a variety of sources of policy failure (Lin, 1989)) or sources of institutional change may be endogenous to actors (changes in preferences, values, mental models, belief systems) (North, 1994). As

one process of institutional change competition between institutions can lead to efficient institutional arrangements regarding transaction and transformation costs (efficiency theories of institutional change, also called functional theories (Schmid, 2004)). A second set of theories assumes that the process of institutional change is described through negotiations between differentially resourceful actors that negotiate about institutional change in view of their interests (distributional theory of institutional change, Knight, 1997; see also Theesfeld, 2005). Finally, actors' interests regarding institutions may be mediated by elections, which leads to the analysis of the institutions that govern elections (New political economy).

Furthermore, what North categorises as direction of change has been called determinants of change by Allio et al. (1997). As such, ideology, transaction costs (and transition costs, see also Challen et al., 2000), path dependencies (caused by network externalities, complementarities and economies of scope and/or the institutional environment) biases change in favour of the status quo. Furthermore, the way interests are organised and the distribution of resources can operate as "determinants of the direction of institutional change".

As last category we suggest Williamson's (2000) proposal that theories of institutional change have differential *time horizons* (see also: Schlüter, 2003). Efficiency theories which explain change as instrumental of transaction and transformation cost economizing explain institutional change on the time scale of 1-10 years. Evolutionary or sociological theories of institutional are suggested as more adequate for theorizing incremental institutional change on the time scale of 100 to 1000 years. We would add that social theories, such as latest Marxist approaches to explaining spatio-temporal, institutional configurations seem to fall into the latter category. However, to what extent this categorisation of theories regarding the explanation of institutional change along different time scales holds could be seriously questioned.

Theoretical strands that we would like to situate in relation to the categories named above are New Institutional Economics, Classical Institutionalism, Sociological Institutionalism, Evolutionary Institutionalism, Historical Institutionalism or theories of spatio-institutional restructuring as they are being developed by critical geographers (Brenner, 2004). However, the scope of this paper does not allow for such more in-depth treatment.

To resume, we suggest using the following categories (and indicative dimensions) to describe, cluster and compare selected theories of institutional change: a) *definition of institutions* (e.g. endogenous, or exogenous to actors, formal or informal, political or economic – these categories overlap with sources of institutional change); b) *conceptualisation of agents* (and implicitly their interrelation to structures – type of rationality, role of ideology and mental models); c) mechanisms of institutional change; c1) *process*: designed – induced or imposed - (competition of institutions over transaction and transformation costs, electoral competition of actors over alternative institutional arrangements or direct negotiation of actors) or spontaneous institutional change (where win-win situation given); c2) *direction of institutional change* (determined by transaction costs, path dependency, institutional environment, ideology, the way organised interest are represented in electoral processes or negotiation powers). d) *time horizon*.

Conclusions

The paper reviewed the understanding of scale and re-scaling that geographers, ecologists, ecological economists, neoclassical economists and institutional economists associated with social-ecological research approaches hold. Our interest

is spatial scales which are measured in units of area or approximate distance. Against this background we defined institutional re-scaling as the way the spatial scales of jurisdictions have been produced/ socially constructed with which institutions are associated. In view of the the complexity and multidimensionality of social ecological relations, each scale is contingently (property specific) embedded into a configuration of multi-, cross-scale, cross-level and intra-level relations.

Subsequently we evaluated the spatial scale dimension of different categories proposed for analysing social-ecological interactions (IoS) and the role of the spatial level of analysis. We then illustrated aspects of social-ecological re-scaling for an illustrative case concerning the reconfiguration of water management in the Algarve, Portugal and developed a set of categories for comparing theories of institutional change. Finally, below we translate the literature review, the illustrative case and the questions derived from categorising theories of institutional change into a research pathway whose aim it is to develop a theory of institutional re-scaling in an iterative fashion.

In order to define a pathway for iterative theory development regarding institutional re-scaling we now want to summarise the three sources described above which provided insights in the potentially explanatory factors: the literature review, the illustrative case and the categorisation and identification of theories that qualify to explain institutional re-scaling and its social construction. We start out with the latter and work our way forward to the former.

Already at this point we can reduce the theories relevant for our purposes as the object of explanation, institutional re-scaling, is more specific than grasping change of various definitions of institutions. In view of our definition of institutional re-scaling we aim to explain the change of *formal institutions* (changes in the administrative level at which homogenous governance structures and property rights for a specific spatial unit are defined). They are *exogenous* to actors and according to Williamson this type of *designed* institutional change concerns the time frame of *10-100 years*. In order to be meaningful for our purposes the selected theories of institutional have to explain the specified characteristics of the object of explanation (change of formal institutions). In this respect we named a variety of theories, which hold different conceptualisations of agents and mechanisms of institutional change.

In view of the above we can now make a first attempt to conceptually break down the question of how to theoretically explain institutional re-scaling. Which are the actors that shape institutional re-scaling? Are these political (central) actors or are these economic (decentral) actors? How do internalised and external structures in which these “entrepreneurs”[9] of institutional change are situated shape institutional re-scaling? What process describes the mechanism of institutional re-scaling? A process of evolutionary selection, a process of competitive selection on the basis of efficiency criteria regarding transformation and transaction costs, a process of direct negotiations between differentially resourced actors, government imposition, or a process of spatio-institutional reorganisation in order to meet the gradually expanding demands of capitalistic production? What determines the direction of institutional rescaling? Path-dependency (and which selective structures determine the path? ideology, transaction costs, resources, the electoral system?)? What role do decisional barriers and territorial identity play. In view of the complex dynamics driving institutional re-scaling in the illustrative case of the Algarve, the authors

[9] A term borrowed from North (1994) which the authors understand as those in a position (endowed with the capacities) to change/ innovate institutions.

contend that several mechanisms of institutional re-scaling provide complementary explanations. Each emphasises a different aspect of the interplay of structures and agents. The conceptual challenge of the empirical complexity of institutional re-scaling is to elaborate the interlinkages between the various mechanisms of re-scaling.

In addition to the propositions for explaining institutional change derived from theory, the literature review pointed at the differences between action arenas at different scales which were singled out by Young (2002) and Ostrom (2005). These factors may similarly explain institutional re-scaling. Therefore, they need to be integrated into hypotheses on the drivers and mechanisms of institutional re-scaling. Specifically, we need to consider differences between actors involved, their number, forces that drive actors' behaviour at different levels, their complexity, and "logics of action selection". We need to consider the importance that key actors at the respective scales award to the relevant activity, the relationships of power among them, "the strategic character of the problem or the structure of relationships among the major actors" and the degree of transparency (Young, 2002:140ff). We need to relate the characteristics of actors to the ways to provide and finance public goods such as institutions and to secure accountability. In this regard the distance of those drafting from those enforcing or benefiting or loosing out from legislation has to be evaluated. Similar to our treatment of scale in the IoS, Young points towards scale specific social context, which varies from local to global context and which has important implications for actors' interactions. Finally, we need to consider the scale at which the environmental problem/ issue emerges and the uncertainty of system's behaviour at specific scales.

As a third source of information for hypothesis building we need to integrate our understanding of aspects of institutional re-scaling through the analytical categories proposed by the IoS. We illustrated them by analysing rescaling of water management in the Algarve, Portugal. We concluded that institutional rescaling coincided with the re-scaling of other aspects. In order to integrate these aspects and the specificities of social-ecological interactions into iterative theory development regarding institutional re-scaling of social ecological systems, these aspects should be evaluated against and possibly translated into the theories of institutional change we intend to evaluate. Definitional consistency or translation of meanings will be key in this exercise. In a second step these aspects should be integrated into or complement the deductively produced hypotheses. Hypotheses should therefore consider the role of upscaling of technology, physical interconnectedness, resources exploited, scale of physical and political powers, mental models, levels of analysis and social embeddedness of actors.

In order to clarify the potential of the various conceptual propositions to explain institutional re-scaling, we suggest to structure the description of each theory using above described categories. Second, we suggest elaborating the implications of each theoretical proposition for institutional re-scaling. These propositions could subsequently be framed as hypotheses for testing in specific empirical cases of institutional re-scaling, such as in the case of the Algarve. Sampling strategy should aim at selecting cases, where similar contextual dynamics take place and lead to shifts in administrative levels which are similar.

References:

Agnew, J, Mitchell, K and Gerard Toal (eds.) (2003) A companion to political geography, Oxford: Blackwell Publishing

Allio L, Dobek, M M, Mikailov, N, Weimer D L Post-communist privatization as a test of theories of institutional change. In: Weimer D L (1997) The political economy of property rights. Cambridge: Cambridge University Press

Archer, M (1995) Realist Social Science: The morphogenetic approach. Cambridge: Cambridge University Press

Beckmann, V. (2002). Transaction Costs and Environmental Economics: Towards a New Approach. Unpublished paper presented in Bloomington, Indiana University.

Berkes F and Folke, C (eds.) (1998) Linking Social and Ecological Systems. Cambridge: Cambridge University Press

Berkes, F (1996) Social Systems, Ecological Systems, and Property Rights. In. Hanna, S S; Folke, C and C. G. Mäler (1996) Rights to Nature. Washington: Island Press

Brenner N (2004) New State Spaces. Oxford: Oxford University Press

Cash D W, Adger W N, Berkes, F, Garden, P Lebel, L, Olsson, P, Lowell, Pritchard and O Young (2006) Scale and Cross-scale Dynamics: Governance and Information in a Multilevel World. In: Ecology and Society, vol. 11, no. 2, article 8

Challen, R. (2000). Institutions, Transaction Costs and Environmental Policy. Cheltenham, Edward Elgar.

Costanza R and C. Folke (1996) The Structure and Function of Ecological Systems in Relation to Property Rights Regimes. In: Hanna, S S; Folke, C and C. G. Mäler (1996) Rights to Nature. Washington: Island Press

Costanza, R, Low, B S, Ostrom, E and J Wilson (2001) Institutions, Ecosystems and Sustainability. Boca Raton: CRC Press

Costanza, R, Low, B S, Ostrom, E and J Wilson Ecosystems and human systems: a framework for exploring the linkages. In: Costanza, R, Low, B S, Ostrom, E and J Wilson (2001) Institutions, Ecosystems and Sustainability. Boca Raton: CRC Press

Cumming G S, Cumming D H and C L Redman (2006) Scale mismatches in Social-ecological systems: causes, consequences, and solutions. In: Ecology and Society vol. 11. no. 1 article 14

Denzau A T. and D C. North (1993) Shared Mental Models: Ideologies and Institutions Economic History, EconWPA. Electronic Resource: http://ideas.repec.org/e/pno11.html, accessed: 19.05.2008

Folke C, Berkes, F and J Colding, Ecological Practices and social mechanisms for building resilience and sustainability. In: Berkes F and Folke, C (eds.) (1998) Linking Social and Ecological Systems. Cambridge: Cambridge University Press

Folke, C, Lowell Pritchard, Jr, Berkes, F, Colding, J and U Svedin (2007) The problem of fit between Ecosystems and Institutions: Ten Years Later. In: Ecology and Society vol. 12, no. 1, article 30

Fritsch, M, Wein, T and H.-J. Ewers (2005) Marktversagen und Wirtschaftspolitik. München: Verlag Franz Vahlen

Gatzweiler, F and Hagedorn, K. (2002). The evolution of institutions in transition. In: International Journal of Agricultural Resources, Governance and Ecology 2 (1), 37–58.

Gatzweiler, F. and Hagedorn, K. (2003). Institutional Change in Central and Eastern European Agriculture and Environment: Synopsis of the CEESA Project. Institutional Change in Central and Eastern European Agriculture and Environment, Vol. 4. Rome: FAO.

Giddens, A (1984) The Constitution of Society. Cambridge: Polity Press

Gualini E (2006) The Rescaling of Governance in Europe: New Spatial and Institutional Rationales. In: European Planning Studies, Vol. 14, No 7, pp. 882-904

Hagedorn, K. (2005). The Role of Integrating Institutions for Multifunctionality. Paper proposed for EAAE Conference, Copenhagen 2005.

Hagedorn, K., Arzt, K. and Peters, U. (2002). Institutional Arrangements for Environmental Co-operatives: a conceptual framework. in: Hagedorn, K. (ed.). Environmental Cooperation and Institutional Change: Theories and Policies for European Agriculture. Cheltenham, Edward Elgar.

Hanna, S and S. Jentoft Human Use of the Natural Environment: An overview of social and economic dimensions. In: Hanna, S S; Folke, C and C. G. Mäler (1996) Rights to Nature. Washington: Island Press

Hanna, S S; Folke, C and C. G. Mäler (1996) Rights to Nature. Washington: Island Press

Hay, C (2002) Political Analysis. Houndmills: Palgrave

Hay, C and Jessop, B (1995) The Governance of Local Economic Development and the Development of Local Economic Governance: A Strategic-Relational Approach. Chicago, September: paper presented to the American Political Science Association

Hay, C Structure and Agency. In Marsh, D. and Stoker, G. (eds) (1995) Theory and Methods in Political Science. London: Macmillan

Hobbs R J (1998) Managing Ecological Systems and Processes. In: Peterson, D L and V T Parker (eds) (1998)Ecological Scale. New York: Columbia University Press

Hodgson, G (2004) The evolution of institutional economics. London: Routledge

Holling, C S and S Sanderson. Dynamics of (Dis)harmony in Ecological and Social Systems. In: Hanna, S S; Folke, C and C. G. Mäler (1996) Rights to Nature. Washington: Island Press

Hooghe L and G. Marks (2001) Types of Multi-level governance. EIOP Online Papers vol. 5, no. 11. Electronic Resource, available at: www.eiop.or.at/eiop/texte/2001-011a.thm

Howitt, R Scale. In: Agnew, J, Mitchell, K and Gerard Toal (eds.) (2003) A companion to political geography, Oxford: Blackwell Publishing

Jessop B (2002) The future of the capitalist state. Cambridge: Polity

Jessop, B (2001) Institutional (re-)turns and the strategic-relational approach. In: Environment and Planning . vol. 33, pp. 1213-1235

Knight, J (1995) Models, Interpretations, and Theories: Constructing Explanations of Institutional Emergence and Change, in: Knight, J and Sened, I (1995) Explaining Social Institutions. Michigan: the University of Michigan Press

Knight, J and Sened, I (1995) Explaining Social Institutions. Michigan: the University of Michigan Press

Lin, J Y (1989) An Economic Theory of Institutional Change: Induced and Imposed Change. Cato Journal vol. 9 no.1

Berger P L and Luckmann T (1986) Die gesellschafttliche Konstruktion der Wirklichkeit. Frankfurt am Main: Fischer Taschenbuch Verlag

Macnaghten, P and Urry, J (1998) Contested Natures. London: SAGE Publications

Marston S A (2000) The social construction of scale. In: Progress in Human Geography 24, 2, pp. 219-242

North D (1994) Institutional Change: A Framework of Analysis, Economic History. Electronic resources: http://ideas.repec.org/p/wpa/wuwpeh/9412001.html#provider, accessed: 10.10.2007

North, D (1990) Institutions, Institutional Change and Economic Performance. Cambridge: Cambridge University Press

Ostrom E The Institutional Analysis and Development Framework. In: Tusak Loehman and Kilgour D M (eds) Designing Institutions for Environmental and Resource Management. Cheltenham: Edward Elgar

Ostrom, E and E Schlager (1996) The Formation of Property Rights. In: Hanna, S S; Folke, C and C. G. Mäler (1996) Rights to Nature. Washington: Island Press

Ostrom, E. (2005). Understanding Institutional Diversity. Princeton: Princeton University Press.

Ostrom, E., Gardner, R. and Walker, J. (1994). Rules, Games, and Common Pool Resources. Ann Arbor: The University of Michigan Press.

Paavola J and W. N. Adger (2005) Institutional Ecological Economics. In: Ecological Economics vol. 53, pp. 353-368

Peterson, D L and V T Parker (eds) (1998)Ecological Scale. New York: Columbia University Press

Powell, W W and DiMaggio, P J (eds.) (1991) The new institutionalism in organisational analysis. Chicago: The University of Chicago Press

Richter R. and Furubotn, E.G. (1999). Neue Institutionenökonomik. Tübingen, Mohr Siebeck.

Rykiel Jr. E. J. Relationships of Scale to Policy and Decision Making. In: Peterson, D L and V T Parker (eds) (1998)Ecological Scale. New York: Columbia University Press

Schlager, E. (1999) A Comparison of Frameworks, Theories, and Models of Policy Processes. In: P. A. Sabatier ed. (1999) Theories of the Policy Process. Boulder, CO: Westview Press.

Schlüter, A (2003) Institutioneller Wandel und Transformation. Aachen: Shaker Verlag

Schmid, A. A. (2004) Conflict and Cooperation. Oxford: Blackwell Publishing

Soper, K (1995) What is Nature? Oxford: Blackwell

Theesfeld I (2005) A common-pool resource in transition. Determinants of Institutional Change in Bulgaria's Postsocialist Irrigation Sector. Institutional Change in Agriculture and Natural Resources, Volume 23. Aachen: Shaker

Thiel A (2008) Europeanisation and the re-scaling of water management as state spatial strategies: the case of the Algarve, Paper presented at American Association of Geographers Conference, Boston, April 2008

Thiel, A (2006) Institutions of Sustainability and multifunctional landscapes: lessons from the case of the Algarve. ICAR Working Paper no.13/6

Thiel, A. (2005). Environmental Policy Integration and water use development in the Algarve since the accession of Portugal to the European Union. Unpublished Ph. D. thesis. Oxford Brookes University.

Turner R K and G C Daly (2008) The Ecosystem Services Framework and Natural Capital Conservation. In: Environmnental Resource Economics, vol. 39: pp.25-35

Turner, M G, Gardner R H and R V O'Neill (2001) Landscape ecology in theory and practice: pattern and process. New York Springer Verlag

Varian H R (2004) Grundzüge der Mikroökonomik. Müchen R. Oldenbourg Verlag

Vatn, A (2005) Institutions and the Environment. Cheltenham; Edward Elgar

Weimer D L (1997) The political economy of property rights. Cambridge: Cambridge University Press

Williamson O E (2000) The New Institutional Economics: Taking Stock and Looking ahead. Journal of Economic Literature. Vol. 28, pp. 595-613

Williamson, O. E. (1985) The economic institutions of capitalism. Free Press: New York

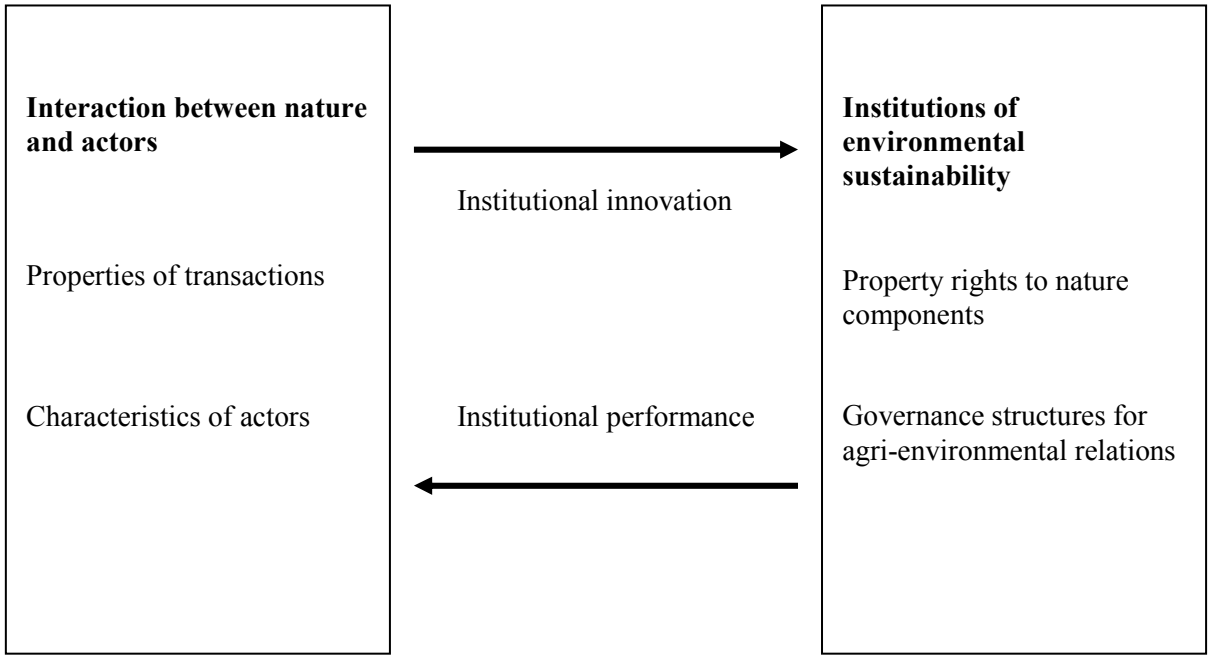
Williamson, O.E. (1991). Comparative Economic Organization: The Analysis of Discrete Structural Alternatives. Administrative Science Quarterly 36, 269-296.

Williamson, O.E. (1998). The Institutions of Governance. American Economic Review 88 (2), 75-79.

Young, O (2002) The institutional dimensions of environmental change. Cambridge: MIT Press

Young, O (2006) Vertical Interplay among Scale-dependent Environmental and Resource Regimes. In: Ecology and Society vol. 11, no. 1 article 27

Figure 1: The Institutions of Sustainability (IoS) framework



Source: Hagedorn et al., 2002; Hagedorn, 2003 and 2005