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Natural resource management: the role of cooperative institutions and governance

ABSTRACT

There are two major discourses on cooperatives and cooperative organizations. One deals with cooperatives for product marketing, inputs, credit, housing, consumers and similar voluntary associations. The other focuses on collective action in the area of provision and management of natural resources, which is gaining in importance due to increasing resource degradation and scarcity. One of the main differences between these two types of cooperative is that the first uses resources artificially pooled by people, while the second uses pools of natural resources that pre-existed the cooperative, which are used by applying appropriate technologies and adding the necessary infrastructure. As the commons literature demonstrates, however, cooperative organization or natural resource management will only lead to successful and sustainable social construction for natural resources if a set of crucial conditions are fulfilled. After discussing two analytical frameworks, the paper presents four cases of institutional analysis of social-ecological systems. They show that actors' interdependence caused by the attributes of nature-related transactions plays a crucial role in institutional choice and the feasibility of collective action in natural resource management.

KEY-WORDS

COOPERATIVE ENTERPRISES; NATURAL RESOURCES PROVISION AND MANAGEMENT; COMMONS.

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1. Introduction

Generations of economists have never tired of emphasizing that market competition combined with private property rights represents a coordination mechanism that needs to be given priority in order to achieve economic efficiency and social welfare. But, as the ubiquity of market failure and limitations of privatization have become more and more visible in the past few decades, particularly in the areas of resource degradation and climate change, this position has lost its attractiveness. Rather, it now seems a prejudice to assume that the capacity to improve economic and social outcomes is a unique characteristic of markets and private property (Bromley 1989, pp. 12-18). Some argue instead that institutional diversity and polycentric governance may be the basic characteristics of strong economies and peaceful societies (Ostrom 2005). To achieve such robust social constructions, common property and cooperative organization – alongside a variety of other types of rules and forms of organization and their combinations – should not play a lesser role than market governance.

Two main historical developments have taught us about the relevance of (formal or informal) cooperatives and cooperative arrangements: the “cooperative movement” in the 19th century and, long before that, the successful cooperative organization of natural resources use (pastures, water, fish, etc.). Recently, additional drivers have emerged, which are increasing and diversifying the relevance of cooperatives and cooperative organization. Particularly in terms of natural resources and the environment, we are now facing more and more crucial issues with high complexity and extreme interrelatedness, such as declining water tables, continuing desertification, the irreversible loss of genetic resources and adaptation requirements due to climate change (Hagedorn 2005). Crafting institutional solutions to these problems will hopefully lead to a diversity of cooperative arrangements that can stimulate participation and knowledge generation while also being open to establishing links to other modes and levels of governance involved in regularizing the interaction of actors in social-ecological systems.

Analysing and discussing the question of when and why institutional choice should involve cooperatives first requires some clarification of terms used in the scientific community when dealing with institutional analysis (see also Hagedorn 2008). There is a basic consensus regarding the understanding of institutions and governance structures in economics and social science in general. For example, Ostrom (1990, p. 51) proposes that “an institution can be defined as the set of working rules that are used to determine who is eligible to make decisions in some arena, what actions are allowed or constrained, what aggregation rules will be used, what procedures must be followed, what information must or must not be provided, and what payoffs will be assigned to individuals dependent on their actions”. Governance structures, such as contracts, networks, bureaucracy, cooperation or markets, are organizational solutions for making institutions effective, that is, they are necessary for guaranteeing rights and duties and their use in coordinating transactions. It is also important to distinguish between “institutions” and “organizations” (Bromley 1989, p. 43). The latter are not themselves institutions, but rather serve to put institutions for regularizing human behaviour into practice.

Actors find themselves in action arenas where “participants and an action situation interact as they are affected by exogenous variables [...] and produce outcomes that in turn affect the participants and the action situation” (Ostrom 2005, p. 13). An action situation occurs “whenever two or more individuals are faced with a set of potential actions that jointly produce outcomes” (Ostrom 2005, p. 32). Although not all actions may be automatically associated with transactions, we are primarily interested in the latter, because they present economically relevant processes by which goods and services, resources and amenities, damages and nuisances are allocated. In a densely populated world with almost no free goods left, we must also assume that these transactions are primary causes of interdependence between actors, because they

affect their opportunities to acquire goods or services, to use resources or amenities and to be protected against damages or nuisances. This interdependence may be in the form of either conflicts or synergisms, to which actors will respond more or less appropriately, leading to interaction between them. The link between transactions and interdependence represents the main cause for institutions and organizations to come into being, as actors work out sets of rules for solving their conflicts and making use of synergisms, particularly if they are able to develop a social rationality (Vatn 2005).

The main objective of this paper is to show that paying more attention to the challenges of cooperation in research on governance of natural resources is worthwhile. It aims to shed light on the conditions under which successful collective action is likely to emerge in natural resource management and the role the properties of nature-related transactions play in this context, e.g. deriving from the interrelatedness and complexity of resource systems and their linkages to physical infrastructure. Attributes of nature-related transactions may interact with characteristics of actors both at an individual and a collective level, which has an impact on actors' interdependence and influences their behaviour, for example by enabling opportunism.

Accordingly, the remainder of the paper is organized as follows. First we introduce a distinction between cooperatives using pre-existing pools of natural resources and others that first artificially pool or accumulate human-made resources (section 2). Then we pose the question of when cooperative organization will likely be an outcome of institutional choice and when it will probably not emerge (section 3). As answering this question requires well-substantiated research concepts, we then outline two primary analytical frameworks for the institutional analysis of social-ecological systems: the Institutions of Sustainability (IoS) framework and the Institutional Analysis and Development (IAD) framework (section 4). After that, an approach employed for deconstructing the process of institutional choice for regularizing nature-related transactions is introduced (section 5). Based on this, we present the conditions necessary for cooperation to be a successful and sustainable social construct for natural resources (section 6). Finally, we describe four examples demonstrating how the factors discussed throughout the paper can be conducive or hindering for the cooperative use, management and protection of natural resources (section 7).

2. Pre-existing pools of natural resources or artificially pooled human-made resources

We start by looking at a core element of cooperatives, as a group of actors jointly using a pool of resources which can be natural or human-made, or a combination of both. Ménard (2004) has explored such institutional arrangements by referring to the concept of "hybrids". The minimum requirement for a governance structure to be identified as a hybrid is that there should be "agreements among legally autonomous entities doing business together, mutually adjusting with little help from the price system, and sharing or exchanging technologies, capital, products or services, but without unified ownership" (Ménard 2004, p. 348). Empirically, the main regularities to be observed in hybrids are "pooling, contracting and competition". The elements constituting hybrids are the following (Hagedorn 2008):

1. Partners who associate in hybrids pool some of their resources, but without collectivizing their property rights. They hence retain their rights to make individual decisions. In such an arrangement, the selection of partners, planning of joint investments and development of reliable ways of communication are crucial issues for the viability of the organization.
2. The prevailing mode of governance for coordinating the individual choices originating from separated decision-making rights resides in contractual relationships. Contracts may act as blueprints which are

usually incomplete and often do not account for specificities.

3. In hybrid arrangements, partners are subjected to competition both between themselves and with other hybrids or types of organization. This requires rules for, and organization of, benefit sharing and dispute resolution (Ménard and Valceschini 2005, p. 424).

This special institutional and organizational setting with hybrids exhibiting such characteristics means that the activities of partners must be harmonized and conflicts between them must be solved. This requires tailored governance structures, as neither command and control nor price mechanisms can fulfil such tasks for hybrids, and “[f]orms of ‘authority’ emerge to govern these complex relationships” (Ménard and Valceschini 2005, p. 424; see also Ménard 2004, pp. 351-354).

In the case of jointly used natural resources, the first constitutional element mentioned above - wherein users “pool some of their resources”, meaning here that human-made capital is transferred into collective ownership or jointly accumulated - does not apply equally. Such cases consist, at least predominantly, of natural capital that has not been individualized. Accordingly we will distinguish between two types of cooperative organization. Both use pools of resources. But in the first case such pools exist as natural resources (for example, common land used by a group of pastoralists), whereas in the second case they have to be pooled and are human-made (for example, joint marketing by a farmers’ cooperative).

Cooperatives using pools of natural resources are often based on long-standing traditional forms of cooperation, sometimes even on indigenous institutions, but many modern cooperative organizations also exist in this field, such as the water-user associations often recommended and supported in developing countries by development cooperation agencies, who see them as contributing towards agriculture-led development. Such common pools are in principle available as a result of natural processes like water generation, which may be subject to degradation (representing a loss of natural capital, e.g. declining water tables). Usually some pooled resources are added for using (transforming and/or transacting) the natural resource (e.g. irrigation infrastructure). In their natural state, before the use and management of these natural resources has been socially constructed via institutions and organizations, they may be considered resources with open access by potential users. In such action situations, actors’ capacities to use the natural resource are solely determined by their physical endowments and not by enforced institutions (rules-in-use) (Ostrom 2005).

A typical case of natural resources that may (or may not) be cooperatively used and managed are “common pool resources” (CPR): characterized by a lack of or limited excludability, but with rivalry. This combination of CPR attributes implies subtractability in resource use (e.g. fish in a lake, water in a basin, trees in a forest) which is different from the kinds of public good where rivalry is missing and taking additional units of that good does not cause marginal opportunity cost. It is important to note that using non-private goods and services originating in the functions of natural systems (ecosystems) that have not been designed by humans is to a large extent associated with “nature-related transactions”. We will come back to this point later and show why this is relevant for achieving institutional fit.

Cooperatives using “artificial” pools of human-made resources rely on collective, mainly human-made, capital provided by their members or jointly accumulated. Generally speaking, the main driving forces leading to the formation of such modern cooperatives can be found in processes of structural change and institutional transformation that individual firms and households had to keep pace with, which they could not have achieved individually. Increasing division of labour due to the industrial revolution replacing traditional household economies and increasing dominance of market governance are two of the main historical reasons for self-organization. Cooperatives emerged to develop the institutional and organizational prerequisites for access to markets. Market integration is still an important function in developing countries and is often combined with collective strategies for quality control and improvement

to secure market shares and lower transaction costs, such as for horticultural cooperatives. Countervailing power on markets is widely accepted as a primary justification for cooperatives, for example agricultural marketing cooperatives.

Poverty, insecurity of livelihoods and the inability of individuals to cover extraordinary expenditures have also inspired the formation of organizations like burial cooperatives and micro-saving groups. Housing and consumer cooperatives emerged to facilitate the covering of basic needs and the avoidance of exploitation. Cooperatives have played an important role in modernization processes, such as when investor-owned firms (IOF) have not perceived sufficient economic incentives for establishing infrastructure (e.g. electricity cooperatives in rural areas). Similarly, cooperatives have often assumed the role of economizing on transaction costs for providing services to small-scale enterprises not provided by IOFs; the emergence of credit cooperatives can serve as an example here. Today, exploiting economies of scale (e.g. by farmers' machine cooperatives) and complex challenges regarding coordination and knowledge (e.g. cattle-breeding cooperatives) are still strong arguments and relevant economic reasons for organizing well-established cooperatives.

In such cases, transactions are predominantly concerned with private goods having a high degree of excludability and rivalry, occurring in physical systems designed by humans, such as processing and marketing facilities. Nevertheless, even such transactions are not fully independent from natural processes, as can be easily seen from the transaction issues associated with perishable goods such as dairy, fish, fruit and vegetables. As the pooled resources do not originate from a natural state of open access, open access is usually avoided from the beginning through bylaws. This means, for example, that agricultural producers in a marketing cooperative have both delivery rights and obligations.

3. Cooperative organization as an outcome of institutional choice

A cooperative is based on particular sets of rules and employs particular structures and modes of organization which have either emerged in processes and discourses or been actively designed by leaders for regularizing and governing interactions and transactions between actors. Such "institutional and organizational fit" between cooperation and the properties of interactions/transactions and the characteristics of actors/action situations does not always occur. Thus, a question arises regarding under what conditions a cooperative solution may successfully materialize, and prove to be a sustainable organization based on robust institutions, and when other institutional and organizational solutions are likely to prevail.

In this context, the following questions arise:

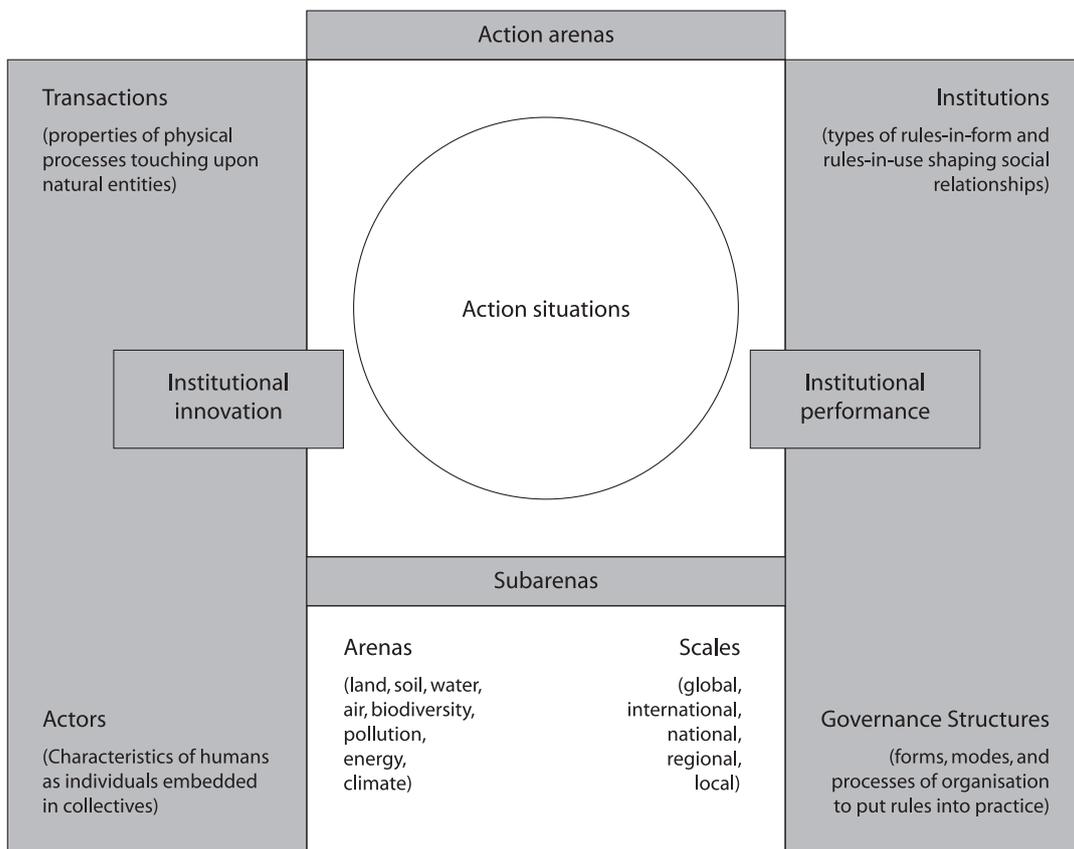
1. How can we explain what and how institutions and governance structures emerge to regularize decisions on the use and protection of natural resources, and what can we learn from this that can be used when crafting such institutions and governance structures?
2. What is special regarding the choice of institutions and governance structures for natural resources, and is this different from areas of institutional and organizational choice?
3. In what natural and social contexts does cooperative governance combined with common property provide a better institutional fit than, for example, privatization, market mechanisms, state property or public bureaucracy?

In the following, we attempt to contribute to the discussion of these questions.

4. Analytical frameworks for institutional analysis of natural resources

To arrive at a proper understanding of institutions and governance structures in the area of social-ecological systems, we have to consider a set of core factors. These are represented in the Institutions of Sustainability (IoS) framework (Hagedorn 2008), which focuses on how to regularize human actions that lead to transactions affecting relationships between natural and social systems (Figure 1). Institutions (sets of rules) and governance structures (which make rules effective) emerge either spontaneously through self-organization or intentionally by human design in single or linked action arenas. How these institutions and governance structures are socially constructed depends on the specific properties of the transactions and the characteristics of the actors involved in given transactions. Such processes take place in action arenas where actors are confronted by an action situation.

Figure 1. Analytical framework for analysing Institutions of Sustainability (IoS)

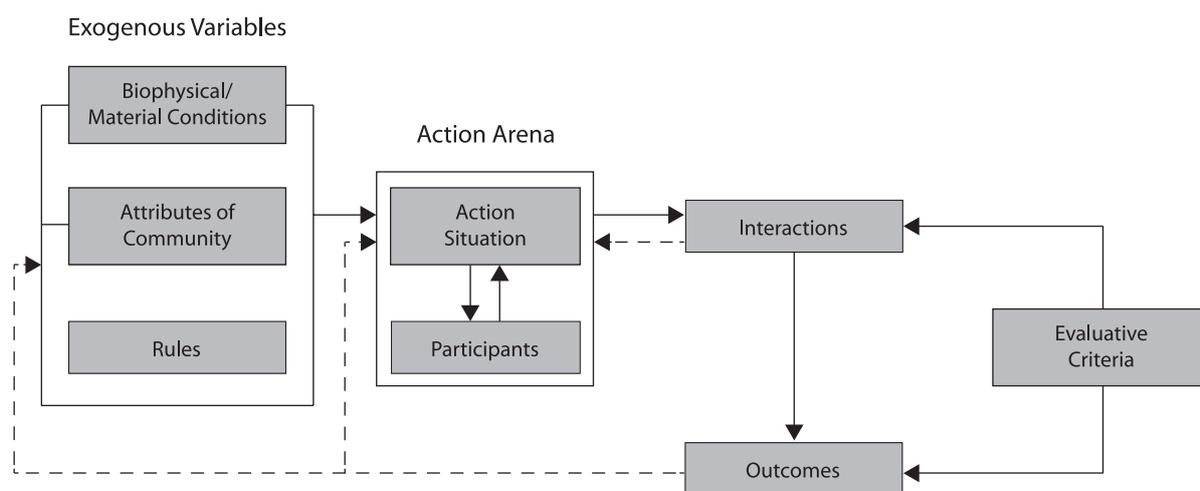


The IoS framework explicitly takes into account not only actor characteristics (such as trust, reciprocity, social capital, shared mental models, etc.) and transaction properties, but also the interplay between these core components. Special emphasis is put on “nature-related transactions” (see Hagedorn 2008), because they have particular properties deriving from the attributes of resource systems and resource units. They also create particular forms of interdependence between actors, which are, in turn, the primary reason for institutions devoted to them to come into being (Paavola and Adger 2005). The (physical) properties of transactions in ecological systems are to a large extent shaped by self-organized ecosystems where human

design plays a limited role, so linkages between activities due to the coherence of the natural system and the interconnectedness of its parts represent particular reasons why such transactions need to be regularized by institutions and organizations.

A similar and widely known analytical perspective that also includes not only actors' characteristics, but also resource attributes, is Ostrom's Institutional Analysis and Development (IAD) framework (1990; 2005) (see Figure 2). Here, collective decision-making processes take place in an action arena consisting of actors and a particular action situation. The situation is influenced by the existing effective institutions ("rules in use"), attributes of the community such as trust and reciprocity and the attributes of the biophysical world. The latter are conceptualized in a slightly different way than in the IoS framework, which includes this aspect as "properties of nature-related transactions". The reason for this is that attributes of resource systems or resource units only become relevant in affecting actors when they are the object of transactions. The internal structure and external context of the action arena cause patterns of interaction, leading to outcomes such as cooperative organization of resource use and resource protection. At the same time, actors develop evaluative criteria which they apply to outcomes in order to decide whether or not they are satisfied with their joint efforts. If not, they will initiate a change in the rules in use to arrive at a better outcome from their interaction in the action arena.

Figure 2. The Institutional Analysis and Development framework



Source: Ostrom, Gardner and Walker (1994)

Although Ostrom does not explicitly consider the relevance of the biophysical world in terms of nature-related transactions, as the IoS framework does, she emphasizes that the biophysical attributes often affect action situations:

“What actions are physically possible, what outcomes can be produced, how actions are linked to outcomes, and what is contained in the actors’ information sets are affected by the world being acted upon in a situation. The same set of rules may yield entirely different types of action situations depending upon the types of events in the world being acted upon by participants” (Ostrom 2005, pp. 24-28).

Accordingly, physical conditions are seen as being equally important as social contexts, because it is the combination of rules with physical reality that generates positive or negative incentives relevant to a specific

action situation. A set of rules may provide incentives stimulating productive outcomes in one setting, but may fail in another setting where the material prerequisites are different. From the numerous studies on common-pool resources available, Ostrom (2005, p. 26) draws the conclusion that, “for example, effective rules depend on the size of the resource; the mobility of its resource units (e.g. water, wildlife, or trees); the presence of storage in the system; the amount and distribution of rainfall, soils, slope, and elevation; and many other factors”.

Given these considerations, we start by looking at a transaction in terms of its physical dimensions and properties, although we must admit that their perception and interpretation are always socially constructed (Hagedorn 2008). Here, we build upon the prevailing definition in transaction cost economics: “A transaction occurs when a good or service is transferred across a technologically separable interface. One stage of activity terminates and another begins” (Williamson 1985, p. 1). But this focus on the economically relevant characteristics of a transaction may be too limited, because it explains the need for a transaction to be governed by institutional and organizational arrangements mainly in terms of “frictions” between activities. A closer look at social-ecological systems, however, reveals that “linkages” between activities are equally important grounds for transactions requiring institutions and governance structures. We will come back to this important distinction.

Physical transactions may involve movement of goods between actors (e.g. when farmers deliver wheat to their marketing cooperative). Such transactions include flows of physical (natural) resources between actors (e.g. when an irrigation manager, authorized by a water user association, provides irrigation water to a farmer). However, physical transactions may also occur without any movement of goods between actors (e.g., when land changes from one user to another). In these cases, the actors move to the resource. Physical transactions not only include direct transfers from one or more actors to one or many others, but transfers may also be indirect, have a spatial dimension, involve time lags, be complicated to reproduce or even be hidden. They may be intended or unintended, targeted or non-targeted, predictable or unpredictable. The actors participating in a transaction may not know each other, and it may be difficult to identify them all. Such properties of transactions are likely to play a greater role if they are related to natural systems than to human-made systems.

Accordingly, a transaction can be seen as a physical phenomenon that is induced by a decision made by one or more actors and affecting one or more actors. The many different sorts of transactions have the potential to cause interdependence between actors, resulting in either conflicts to be solved or opportunities for cooperation. This is the very reason why they need to be regularized by institutions and governance structures. In other words, there is also an equally important institutional side associated with a physical transaction. Thus we not only need to consider physical transactions, but also institutionalized transactions, which represent transfers of entitlements or constraints on goods or resources that need to become regularized by institutions and governance structures, such as transfer of water rights on water markets or the governance of water use by water user associations. From this perspective, transactions “are the alienation and acquisition between individuals of the rights of future ownership of physical things” (Commons 1934, p. 58; see also Schmid 2004).

The broader view on transactions that we are developing here not only distinguishes between physical and institutionalized transactions, but also between frictions and linkages as relevant properties of transactions. When dealing with institutional analysis focused on natural resources, making this latter distinction is crucial, because transaction cost theory usually deals with transactions that can be seen as transfers of commodities, meaning goods predominantly produced by engineered processes in designed systems set up by humans. By contrast, institutional analysis in social-ecological systems often focuses on non-commodities: resources, goods and services whose transactions involve processes of self-organization

in ecosystems not completely engineered by humans. Consequently, institutional analysis of social-ecological systems should take into account additional properties of transactions deriving from the physical characteristics particularly, though not exclusively, observed in natural systems, such as jointness, coherence and complexity (Hagedorn 2008).

As a consequence, the transaction-based perspective developed by Williamson cannot be applied fruitfully to non-designed systems in the same way as it is applied to designed systems. For the former, its limited view that “transaction costs are the economic equivalent to frictions in physical systems” (Williamson 1985, p. 19) needs to be extended, because governance costs can also arise from the phenomenon of interconnectedness in systems. Regulation of regional water levels, for example, has an impact on plant growth and crop yields, biodiversity and wetland conservation, the appearance of landscapes, lakes and rivers, water provision for households, power plants and other industries, and consequently may cause problems of coordination and consensus building between many stakeholders.

The question arises of why the prevailing concepts of transaction cost economics have not seriously accounted for nature-related transactions. The reason, I propose, is that the properties of transactions it emphasizes (uncertainty, frequency and asset specificity) have been discovered in areas of production and trade where transactions are usually separable, because a high degree of decomposability, modularity and independence often exists in these areas. Here, the “commodities” transferred are mostly produced by engineered processes that take place in designed systems set up by humans. Consequently, frictions in the system that separate activities are perceived as the reason why a transaction needs to be governed.

This is different in the case of “non-commodities”: goods and services, resources and amenities, but also damages and nuisances, which are to a large extent provided by, or through, self-organized ecosystems where human design plays a limited role. Here, linkages between activities due to the coherence of the system and the interconnectedness of its parts may explain why transactions have to be regularized by institutions and organizations. Both frictions and coherence can cause interdependencies between actors that need to be governed. This adds another aspect to the above-mentioned view regarding the origin of transaction costs (Williamson 1985, p. 19). They may not only be “friction costs” (Williamson 1985, p. 18f.), but also what could be called “coherence costs”.

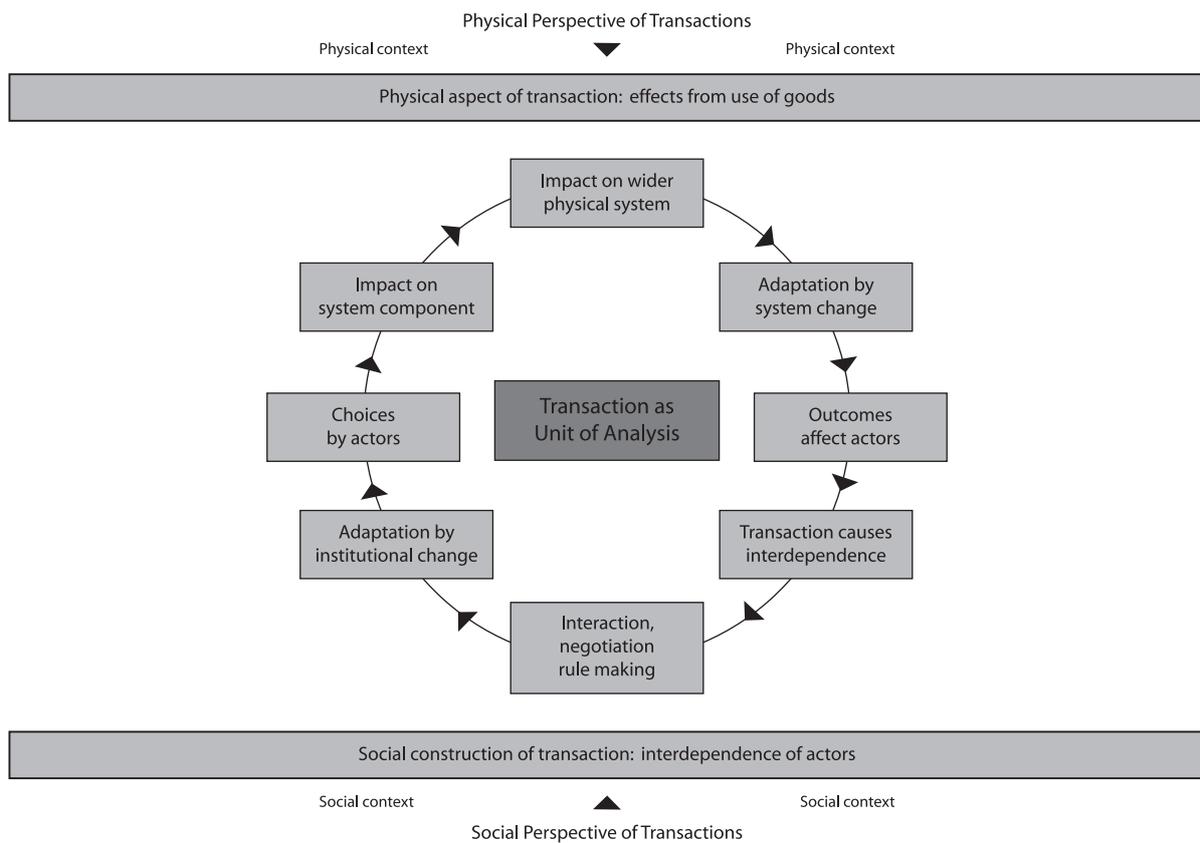
Due to all of these factors, institutional analysis in social-ecological systems has to take into account additional properties of transactions resulting from attributes especially observed in ecosystems, such as jointness and absence of separability, coherence and complexity, limited standardizability and calculability, dimensions of time and scale, predictability and irreversibility, spatial characteristics and mobility, adaptability and observability. For example, due to the interconnectedness of the natural system, nitrogen fertilizer use by farmers represents a transaction that affects other actors in various – often both desired and problematic – resulting in a complicated action situation. Applying high levels of nitrogen or manure to crops certainly increases yields and may, under certain conditions, also improve soil fertility. However, these beneficial effects may be accompanied by numerous adverse effects, such as emission of greenhouse gases (N₂O), affecting third parties.

5. The process of institutional choice in regularizing nature-related transactions

Now the question arises of how an appropriate institutional fit for nature-related transactions can be found or, in other words, how a physical transaction occurring in a social-ecological system can become an institutionalized transaction. Institutions arise or change due to transactions that cause or reveal

interdependence between actors (Paavola and Adger 2005, p. 355). Governing such interdependence can be conceptualized with the idea of “discriminative alignment”: the analytical process by which “transactions are aligned with governance structures” (Williamson 2000, p. 599), representing a core element of transaction cost economics. We apply this concept by considering the transaction-interdependence phenomenon from two different angles: the (physical) transaction of a good or resource and the (social) interdependence between actors or organizations (see Figure 3).

Figure 3. The transaction-interdependence cycle: decomposing institutional choice in social-ecological systems



The transaction-interdependence cycle includes the following stages (Hagedorn 2008). First, actors choose an action (e.g. to apply nitrogen fertilizer) that entails transactions involving one or more other actors. Such choices subsequently affect ecosystem components for resource users (e.g. nitrate in water flows in soil) and may also impact the wider context of the natural system (e.g. pollution of an adjacent lake). Ecosystems and hydrological systems respond to these changes through adaptation processes (e.g. loss of fish population). At this point, other actors may be affected by the physical transaction (e.g. fishermen lose income). As soon as the actors participating in the transaction recognize their interdependence regarding the use of the natural system, their relationship changes, which provokes a response. This stimulates interaction between actors concerned (water users), prompting discourses, negotiations, and consensus building on rule making, a process which may also involve agents such as politicians, bureaucrats and lobbyists. Adaptation processes (e.g. regarding rules on water pollution) can then result in institutional change and new governance structures. Once the transaction becomes institutionalized, actors will adjust their choices according to the rules and enforcement mechanisms.

6. When is cooperation the outcome of the transaction-interdependence cycle?

What we are interested in is being able to discern when cooperation in governing natural resources is likely to be the outcome of the transaction-interdependence cycle. The most substantiated answer to this question can be formulated by referring to the pathbreaking work on why, when and how people cooperate in using natural resources done by Elinor Ostrom (2005) together with numerous scholars who are part of the Bloomington School network. To some extent, their unique research process can be seen as a counter movement to the “Tragedy of the Commons” which, according to Gerret Hardin (1968), cannot be avoided without either privatizing the CPR or managing it via government bureaucracy. By contrast, empirical evidence from numerous case studies shows that cooperation can work in the case of CPR, meaning that users of CPR are able to solve their problems by crafting rules and forming organizations by themselves. Ostrom (2002, p. 1325) maintains that, based on research results reported by numerous authors “on the origin of self-governed common-pool resources”, a credible “consensus exists that the attributes of resources and of appropriators summarized in Table 1 are conducive to an increased likelihood that self-governing associations will form”.

Table 1. Conditions for cooperation as governance of common pool resources

<p><i>Attributes of the resource:</i></p> <p>R1. “Feasible improvement: Resource conditions are not at such a point of deterioration that it is useless to organize or so underutilized that little advantage results from organizing.</p> <p>R2. Indicators: Reliable and valid indicators of the condition of the resource system are frequently available at a relatively low cost.</p> <p>R3. Predictability: The flow of resource units is relatively predictable.</p> <p>R4. Spatial extent: The resource system is sufficiently small, given the transportation and communication technology in use, that appropriators can develop accurate knowledge of external boundaries and internal microenvironments.</p> <p><i>Attributes of the appropriators:</i></p> <p>A1. Salience: Appropriators are dependent on the resource system for a major portion of their livelihood.</p> <p>A2. Common understanding: Appropriators have a shared image of how the resource system operates (attributes R 1, 2, 3, and 4 above) and how their actions affect each other and the resource system.</p> <p>A3. Low discount rate: Appropriators use a sufficiently low discount rate in relation to future benefits to be achieved from the resource.</p> <p>A4. Trust and reciprocity: Appropriators trust one another to keep promises and relate to one another with reciprocity.</p> <p>A5. Autonomy: Appropriators are able to determine access and harvesting rules without external authorities countermanding them.</p> <p>A6. Prior organizational experience and local leadership: Appropriators have learned at least minimal skills of organization and leadership through participation in other local associations or learning about ways that neighbouring groups have organized”.</p>
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Source: Ostrom (2002, p. 1325).

Actors who use a local or regional natural resource system are usually affected by higher levels of governance, such as political decision makers, ministries and public administrations or umbrella associations of cooperatives. Ostrom (2002, p. 1325f.) emphasizes that:

“[...] these larger regimes can facilitate local self-organization by providing accurate information about natural resource systems, providing arenas in which participants can engage in discovery and conflict-resolution processes, and providing mechanisms to back up local monitoring and sanctioning efforts. The probability of participants adapting more effective rules in macro-regimes that facilitate their efforts over time is higher than in regimes that ignore resource problems entirely or, at the other extreme, presume that all decisions about governance and management need to be made by central authorities”.

In other words, interference by actors belonging to other units of governance can be both constructive and destructive in nature.

7. Four examples of cooperative natural resource management

In light of the conceptual background provided in the previous sections, in this section we look at some empirically investigated cases in order to show how the factors outlined above can be conducive or hindering to cooperative use and management of natural resources.

The examples have been selected from projects conducted by the Division of Resource Economics at Humboldt University Berlin together with international research partners. Reflecting the analytical frameworks discussed in section 4, description of results from these cases is intended to show that not only the characteristics of the actors involved, but also nature-related transactions and infrastructure are crucial for cooperation in natural resource management.

7.1. Cooperative natural resource management in a post-socialist context (Bulgaria)

Theesfeld (2005; 2009) has analysed irrigation systems in Bulgaria that rapidly degraded, physically and institutionally, after the transformation of the political and economic system in the 1990s, followed by attempts at institutional redesign and reorganization. In this process, the World Bank and the Bulgarian government tried to establish water user associations, a worldwide model for farmers' cooperation in water use. These efforts, which were intended to enable collective action as an institutional solution for the irrigation sector in a post-socialist transition process, exhibited many cases of failure. According to Theesfeld (2005, p. 251) “[e]mpirical findings support the theoretical propositions that certain transition-specific features are predominant within the analyzed context: information asymmetry, incongruity of formal and informal rules, limited tradition transfer, opportunistic behaviour, and deteriorating social capital”.

Formal rules were not lacking, but due to ineffective monitoring and sanctioning mechanisms they were not enforced. Often, resorting to physical power seemed to be a rule in use, and violence among the users played a considerable role. As an example of the abuse of power, Theesfeld describes a water user association that was established in a village in a top-down manner by influential members of the former nomenklatura:

“Most of the villagers were in fact unaware of the possibility of establishing a WUA, much less knew about the formal existence of a WUA in their village. The villagers, rather, spoke of this organization either as a private water firm or as a tenant renting the canals system. They were only aware that the water guard was from their village, without knowing the other parties involved. [...] Information asymmetry was striking, as villagers knew hardly anything about the formal existence of the WUA” (Theesfeld 2009, p. 234).

Although a tradition of collective water use had existed in Bulgaria in the pre-socialist era in the form of water syndicates, post-socialist reforms could not build on this. The collective memory was too weakened, as discourses on alternative forms of organization were prohibited under the socialist regime.

Theesfeld interprets this action situation as a “vicious cycle”:

“To simplify the interrelations among the five transition-specific features, limited tradition affects the social capital and leads to its first deterioration. Information asymmetry and the incongruity of formal and informal rules – in addition to other transition-specific features – build a ground on which opportunistic behavior can grow. Opportunistic behavior and deteriorating social capital emerge [...] as core transition-specific features influencing institutional change. Opportunistic behavior along with power abuse further deteriorates social capital, which is already low in transition countries. Deteriorating social capital, including low levels of interpersonal trust and other indicators [...] facilitates the milieu in which opportunistic behavior can persist” (Theesfeld 2005, p. 251).

However, the actors’ interdependence associated with this opportunistic behaviour could only emerge because of the properties of transactions related to both the natural resources – land and water – and the human-made physical infrastructure of canals. In particular, the resources nexus between land and water tied the process of land privatization to the necessity of reforming the rural water sector. The resulting challenges have strongly influenced the processes of institutional change and limits of cooperation in this case.

7.2. Decentralizing agri-environmental programs by farmers’ cooperation in agri-environmental cooperation groups (Germany)

As a part of the GRANO project¹, agri-environmental cooperation groups were introduced into the design of agri-environmental measures at a regional scale in North-east Germany. Although establishment of the cooperation groups required considerable input in terms of knowledge, coordination and consensus building, the project was rather successful to a point, and was able to formulate specific concepts, such as a “regionalized soil protection programme”. From the beginning of this process, the Ministry of Agriculture, Environmental Protection and Spatial Planning of the federal state of Brandenburg supported the agri-environmental cooperation groups. However, when they were finally asked to support the implementation of the specific programmes the members of the cooperation groups had agreed upon, they argued that there were irremovable obstacles against it. The communicated arguments were that additional financial means would be required, administrative costs would increase, farmers not participating in the cooperatively designed measures would be discriminated against, and, finally, proof of the superiority of the agri-environmental measures based on the cooperative agreements of the agri-environmental cooperation groups was lacking (Eggers 2005, pp. 14-16).

¹ GRANO is the German acronym for “Shaping Typical Regional Landscapes in North-east Germany”.

After the GRANO project was finalized, Eggers (2005) conducted an *ex-post* analysis of the process, focusing on the question of what factors had obstructed an institutional change that could have led to the decentralization of agri-environmental programmes. His results reveal several reasons why cooperative organization of the design and implementation of agri-environmental programs failed due to actors' behaviour at other levels of governance.

First, the high requirements of monitoring and control from the European Union, and the administrative burden for the individual federal states (Bundesländer) resulting from this, counteracted effective local cooperation and implementation of specific regional measures as they had been developed by the agri-environmental cooperation groups. The objective of thwarting the abuse of EU funds, which is a driving force of centralization, could not be reconciled with the objective of achieving higher ecological effectiveness by applying a more polycentric approach.

Secondly, the interests of actors at the different levels of governance represent another obstacle against the implementation of local cooperative and participatory approaches, as administrators were afraid of losing power and influence. The main determinants in this area were the strong risk aversion of bureaucrats leading to an avoidance of collaboration with cooperative organizations on the ground, lack of interest of national and EU officials in effective decentralized and participatory approaches and the strategy of agricultural interest groups, who tried to block initiatives emerging from outside the traditional agricultural policy network.

Third, the complexity of the institutional change associated with the implementation of agri-environmental cooperation groups (i.e. collective action) requires considerable knowledge and information which is unequally distributed among actors, organizations and levels of governance. In particular, many people (farmers, citizens, administrators, political decision makers, the general public) are not aware of the advantages decentralized and participatory forms of organization can have on the effectiveness and efficiency of agri-environmental measures. Powerful, high-level administrators especially profit from this lack of transparency. They prefer that farmers and both the rural and urban populations do not become "sensitized" regarding this potential deficit. In addition, the specific knowledge of officials in the administration plays a dominating role, and this human capital would be devalued by institutional change towards a more decentralized and cooperative organization of the programmes.

The refusal of the public administrators implementing agri-environmental programmes to link up with local and regional forms of cooperation and participation can be considered the main reason for the erosion of the willingness of local farmers to engage in a cooperative arrangement. This has been particularly emphasized by Arzt (2009, p. 286), who conducted a second *ex-post* analysis focused on the internal group dynamics and discourse processes within the agri-environmental cooperation groups. This case shows that polycentric institutions including cooperative arrangements may be preferable for the governance of nature-related transactions, but may not materialize due to the vested interests of external actors.

7.3. *Collective action in watershed management and participation of the poor (India)*

In his investigation of collective action in watershed management, with particular consideration of participation by the poor, Srigiri (2013) looks at Indian regions where the government, like many other governments in less industrialized countries, compensates communities for the costs of collective management of natural resources. This is necessary because most of the peasants, particularly in the semi-arid tropics, make their living from subsistence or semi-subsistence agriculture. As they are poor, they cannot finance major investments in the management and improvement of natural resources. In this social and

natural context, governments play a twofold role: they contribute towards investment into a given resource and, at the same time, devise the institutional and organizational construction of the resource system in order to facilitate collective action as a strategy to achieve sustainability in its use. Although communities receive capital and knowledge in this way from external sources, utilizing these inputs properly requires a sufficient level of self-organization (Srigiri 2013, pp. 91-93).

The development of plans, decision making and implementation occurs at various levels, including self-help groups, user groups and watershed associations. Watershed committees supervise the implementation of plans formulated by user groups and self-help groups. Decisions or plans that are considered important must be agreed upon during meetings of the watershed association. The watershed committee also has the task of monitoring and enforcing the rules of watershed management. The regularity and frequency of watershed association and watershed committee meetings are crucial for the efficient organization of a watershed community and efficient collective action. For individual households, it is important to participate in decision-making activities in order to benefit from such watershed management projects.

Srigiri (2013) has analysed this action situation and to what degree collective action comes into being by looking at three sub-arenas of the action arena:

“The distinction among different action sub-arenas is based primarily on the type of action done in the arena and the temporal stage of its occurrence. [...] There are two main distinguishing features, first, the costs borne by the actors for different actions are different, and second, the ‘selective incentives’ for these actions are not the same for all actions that lead to watershed development” (Srigiri 2013, pp. 92-93).

Based on the differences regarding the properties of the action situations and their position in the sequence of decision making, Srigiri (2013, pp. 93-94) distinguishes three relevant sub-arenas: “planning and decision making, soil and water conservation investments and maintenance and resource use”.

Results from this study show that a broad consensus among the members of watershed communities regarding the rules of watershed management was an enabling factor for self-enforcement by the community. If the rules were developed by collective decision making, it was more likely that they became effective in the sub-arenas mentioned above:

“Procedural fairness is found to be vital in order to achieve consensus on rules. A fair process of rule formation must include all the active groups with different interests. High levels of attendance in watershed committee meetings led to greater degree of consensus which further led to higher levels of voluntary labor contributions in communities” (Srigiri 2013, pp. 119-120).

Nevertheless, participation in collective action also turned out to be limited. The decision-making bodies were dominated by farmers who were wealthy or members of upper castes and had access to irrigation. This does not mean that the poor, including the landless groups in the villages and low caste households, were excluded from the executive committees. However, they had only a little influence in these groups. In addition, other factors played a role, for example the proximity of households to leadership and the social and economic homogeneity of communities. Households with a perception of fairness in the distribution of benefits were motivated to attend meetings. Expectations like these are based on former experience with collective action; “hence the process is cyclic, as a sequence of action arenas keeps repeating itself” (Srigiri 2013, p. 120).

This case reveals the main problems of governing nature-related transactions if they are linked to complex attributes of a natural resource system that is affected by degradation processes. To cope with the urgent

task of saving the resource, participatory management is necessary, which requires knowledge generation and collaboration from those who are the immediate users of the resource. In such a situation, cooperation can be very effective in terms of making sustainable resource use feasible. However, the characteristics of actors involved, in particular their action resources, sometimes prove detrimental to the cooperative form of governance. Combining local cooperation with higher levels and hierarchical modes of governance (which is unavoidable in the described case) seems to pose particular challenges.

7.4. Pastoralism as indigenous cooperative organization of resource use (Ethiopia)

This example refers to two studies on cooperation and conflict management in Ethiopian pastoralist systems. Hundie (2008) has analysed the organization of Afar pastoralists in Ethiopia by focusing mainly on two aspects: the conflictive interactions among the actors involved in institutional change and the institutional deficits that have emerged in this process. Secondly, the institutions and organization of cooperative interactions between clans, ethnic groups and households have also been analysed. Beyene (2008) has investigated similar issues facing Somali pastoralists in Ethiopia by analysing the dynamics of property rights, collective action and the role of customary institutions in securing rights and coordinating collective action among agro-pastoralists in governing common property resources.

The Ethiopian state, via its administration, confiscated a large area of Afar rangeland in order to establish commercial farms (without paying any compensation). This government intervention into traditional property rights has been causing conflicts, because it crucially reduces Afar options for adaptation in periods of resource scarcity. For example, after recurrent drought, the Afar have to cross the boundaries of other tribes or clans to graze their cattle. Because of this, effective traditional institutions to manage inter-clan and inter-ethnic conflicts have been created:

“[...] the temporal and spatial variability of rangeland resources necessitates movements of livestock and human beings beyond clan territories on a regular basis. Virtually, such cross boundary movements entail bargaining and cooperation among different groups having de facto rights over pastoral resources. In this regard the study shows the existence of both inter-clan and inter-ethnic cooperative interactions” (Hundie 2008, p. 179).

Beyene (2008, p. 200) also points out that such specific common property rights are of major relevance for the sustainability of cooperation in natural resource use. Established social relationships, kinship structures and geographical proximity determine how rights are defined and enforced for the Somali. Besides many variations between different socio-cultural situations, the following general attributes apply:

“[...] 1) the lineage setting is compatible with herd mobility and 2) the customary tenure arrangements usually devise institutional mechanisms to tackle unpredictable swings in pasture productivity. These scenarios lead to an understanding that locally organized collective action is a response to deal with ecological challenges affecting local livelihoods with a focus on improving resource availability and strengthening group solidarity to buffer the effect of environmental risk” (Beyene 2008, p. 200).

Similarly, cooperative institutions shape relationships at a household level. As formal insurance or safety nets do not exist in pastoralist groups, mutual help mechanisms at a local level are important. They are still effective, for example in the Afar region. However, households which are better socially integrated participate more intensively in mutual help arrangements. In other words, these social networks can be

considered as a resource for securing household livelihoods. Poor households, which only have a limited capacity to donate or reciprocate, consequently participate less in the pastoralists' self-help interactions (Hundie 2008, p. 180).

Beyene (2008, p. 203) emphasizes a crucial challenge to customary pastoral systems regarding their cooperative use of common property: the widespread existence and expansion of enclosure. The government enforces this by privatizing property rights of land commonly used by pastoralists in order to create and secure income streams, particularly for poor smallholders. However, this undermines core elements of pastoralist institutions which are indispensable for the sustainability of the collective grazing system in these particular social-ecological systems. Pastoralist groups themselves must be allowed to decide on whether, at what time and by whom their natural resources are to be privately or collectively used, because:

"[...] the shift between private and common property rights is primarily determined by the possibility to manage risk in a variety of ways. For example, the fact that rights are constantly redefined in different resource settings to pool ecologically determined production risks indicates the influence that the unpredictability of the rangeland resources has on institutional choice of different clans" (Beyene 2008, p. 203).

In pastoral systems, the necessity of humans to base their livelihoods on fragile ecosystems implies difficult nature-related transactions which have given rise to complex institutions that easily become dysfunctional when disturbed by external intervention or changes in the social environment.

The fact that these institutions have been considerably degraded by economic and political developments is in part, but not only, due to the fact that Horn of Africa countries are permanently involved in civil wars which increase the availability of guns. This influences the nature of livestock raiding, an indigenous institution in pastoralist systems.

"Livestock are resources that can be accumulated through production (by applying peaceful institutions) or through raiding (by applying institutions of violence) among Afars and their neighbors. As a forced contract, livestock raiding has also traditionally existed among other pastoral groups of East Africa since immemorial time [Galaty and Bonte 1991; Otim 2002]. While raiding as a cultural phenomenon contributes to conflict [in the study areas] culture provides solely a partial explanation for the existence of raiding. Nowadays, raiding occur not only for cultural reason but also to earn income by selling the animals in open markets. Indeed, this is due to the integration of the pastoral economy in the commercial economy, which is associated with increasing access to external and domestic livestock markets" (Hundie 2008, p. 111).

The change in the incentive for livestock raiding from "culture" to "commerce", arising from the opportunity to sell the raided animals, is likely to influence the frequency and extent of such conflicts (Hundie 2008, p. 111). This has led to an increase in the frequency and brutality of the raiding, resulting in more and more large-scale raids and counter-raids associated with great bloodshed among the fighting groups. At the same time, commercial raiding involves more actors who no longer feel committed to traditional norms and values than traditional cultural raiding, for example livestock raiders and traffickers of illegal arms, so that indigenous institutions lose their effectiveness in managing ensuing conflicts. Above all, commercial raiding is associated with trading the captured cattle over long distances. This means that negotiations to return the animals to the victims, which have been a habit according to the indigenous institutions, will no longer be effective. This increases violence, because victim groups are consequently motivated to engage in retaliatory action.

8. Conclusions

The cases described above reveal a high degree of diversity as regards the feasibility and sustainability of collective action. However, the core drivers behind these outcomes are obvious. There seems to be an omnipresence of interplay between the properties of nature-related transactions strongly influenced by physical infrastructure installed for using and managing the natural resource, on the one hand, and actors' characteristics on the other, resulting in corresponding behavioural orientations. Maybe even more than in the case of cooperatives that use artificial pools of human-made resources, those using pre-existing pools of natural resources are depending on facilitating behaviour and appropriate capacities of "larger regimes", as Ostrom (2002 p. 1325f.) called them, and are vulnerable to opposite impacts from higher levels of governance.

The case of irrigation reform in the post-socialist transformation process in Bulgaria shows in particular that applying organizational blueprints for collective action, in this case the top-down establishment of water user associations, can hardly be effective if the social context – including political transition processes, institutional reforms, lacking or interrupted traditions, insufficient social capital and a weak state – are not taken into account. The attempt to implement imported institutional transplants from abroad is prone to failure, if these special social and political conditions are neglected. The resource nexus between land and water played an important role because it made privatization of land and redesigning the irrigation systems inseparable. This demonstrates that linkages between natural systems influencing nature-related transactions have a considerable impact on how institutional change occurs.

While it may be plausible that a weak state is not able to adequately support self-organization, it may be surprising that the German case of agri-environmental programmes can reveal how even a strong state, which in principle is able and willing to craft effective and efficient institutions, can fail to reap the benefits from cooperation and participation, although the properties of the given nature-related transactions would require such a shift in governance. The analysis of the agri-environmental cooperation groups as a means for decentralization of agri-environmental programmes confirms the result stressed by Ostrom and her colleagues from the Bloomington School that government interference that does not leave sufficient room of manoeuvre for self-organization can be detrimental to the emergence and sustainability of cooperative organization, even though it would enable a better fit with nature-related transactions.

The example of cooperative watershed management in India shows that social capital and social structures are crucial for the feasibility and the efficiency of collective action in natural resource use and improvement. The action resources available to the participants in the action arena – such as personal power, education and knowledge, and also physical access to resources (in this case irrigation) – have proved to be influential factors. One important issue that deserves attention is the role of poverty, because it involves other levels and types of governance in local cooperation processes. This is because it requires support for financing investments in resource protection and provision of expertise for making the core intended nature-related transactions, such as water harvesting, possible. This opens the action arena to possibly harmful interference from administrators and rent seeking at the local level.

Government intervention also plays a crucial role in regards to attempts to "modernize" pastoral systems in Ethiopia. Here again, the relevance of nature-related transactions can be observed, as a top-down redesign of customary pastoral institutions and the habits they have created may destroy their institutional fit with the fragile ecological systems on which the livelihoods of pastoralists depend. This case shows how changes in the external social and economic context of the resource use systems can destroy indigenous

institutions of cooperation and conflict resolution in some areas (e.g. the raiding culture), while they are still functioning in other areas (e.g. mutual help among households). This case gives an impression of the challenges of reforming indigenous cooperative institutions and organizations, a task that has to recognize the complexity of the action situation in order to avoid scholars and policy makers falling into panacea traps (Ostrom 2007). Obviously, for nature-related transactions that are mediated through ecosystems exhibiting high complexity and interconnectedness, a good institutional fit can often be achieved by cooperative governance, but at the same time sustainability of cooperation may be endangered by internal and external forces. In addition, the use and management of natural resource system usually requires technologies, equipment and infrastructure that make transactions and associated interdependencies even more prone to opportunistic behaviour. The inseparability of social-ecological systems from social-technical systems, together with actor characteristics, interests and action resources, may prevent a desirable institutional design combined with cooperative governance from materializing. Why particular actor behaviours emerge in specific action situations may also be explained by an important difference between the two types of cooperatives mentioned in section 2. Cooperatives artificially pooling human-made resources usually do what people cannot do alone. This also applies to cooperatives based on pre-existing pools of natural resources. However, these often have to formulate solutions that cooperatives cannot achieve alone, and they must also rely on constructive collaboration with other levels of governance.

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