

# Cities as laboratories of socio-ecological transition: The transformative role of urban commons<sup>1</sup>

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*Thomas Sauer (EAHJ), Susanne Elsen (UNIBZ), Stefan Kuhn (ICLEI), Stephanie Barnebeck (EAHJ), Cristina Garzillo (ICLEI), Yannick Kalff (EAHJ), Judith Schicklinski (UNIBZ)*<sup>2</sup>

## 1. Urban commons

Right from the beginning a significant stream of the movement for 'reclaiming the commons' directed the focus on the urban commons as well. Investor's striving for an "ever-higher rent from a given area" was identified as a driving force behind urban enclosures, sometimes provoking severe resistance of urban communities against it (The Ecologist 1994, 116). In this context city centres, shops, and streets were named as urban commons (Vinay Sreenivasa 2011, 261). But furthermore, the concept of 'urban commons' covers as well enclosures of public spaces and infrastructure, management of networked infrastructure, 'commoning' practices, like the contestations between the state and the community, the use of streets, parks, and parking spaces; as well as local security issues (Bhuvaneshwary Raman 2011, 267–68). Concerning the concept of the commons as such we follow the view that it is "constituted of three main parts: (a) *common* resources, (b) institutions (i.e. *commoning* practices) and (c) the communities (called *commoners*) who are involved in the production and reproduction of commons" (Markus Kip et al. 2015). Concerning the urbanity of commons some refer to the city as 'the source of the commons and the receptacle into which it flows'. According to this view, the city is not just built environment "but also a living dynamic of cultural practices, intellectual circuits, affective networks, and social institutions" (Michael Hardt and Antonio Negri 2009, 154) Observing that the value of urban real estate is "primarily determined by externalities---both negative externalities" they assert: "In these externalities we encounter a specter of the common". (Hardt and Negri 2009, 154–55). Here we want to investigate the question whether certain types of common-pool resources could be considered as key urban commons: energy, water and green spaces, assuming that these resource systems might be crucial for an in-depth sustainability transition.

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<sup>1</sup> This paper is built on Thomas Sauer et al. (2015).

<sup>2</sup> EAHJ Ernst Abbe University of Applied Sciences Jena, UNIBZ Free University of Bolzano, ICLEI Local Governments for Sustainability – European Secretariat Freiburg. Correspondence please mail to [thomas.sauer@fh-jena.de](mailto:thomas.sauer@fh-jena.de)

## 2. Motivation

Since the 1992 Earth Summit of Rio de Janeiro, the concept of sustainable development became more and more mainstream in global political thinking. The central question that arises concerning the implications of core planetary boundaries (Johann Rockström et al. 2009) is, whether the problems of global warming and violation of planetary boundaries are unsolvable social dilemmas in economic reality. Not at all, if the economic sciences were to shift their focus from internalising the externalities towards the search for a more comprehensive economic approach regarding the governance of commons and the resilience of resource systems. Therefore, new institutional arrangements beyond the simple market-government dichotomy are needed to enhance human prosperity without overstretching the earth's capacity to recover its resources. The assumption here is that a transition towards a post-growth regime of strong sustainability presupposes the transition of the economic system towards a higher degree of institutional diversity. Experiments with new forms of economic governance could pave the way towards newly diversified economic systems which are expected to be independent of the ever-growing consumption of natural resources.

There are strong reasons to look at such processes of institutional diversification and change, taking the multi-level character of governance of the global commons into account at the same time: "[...] while many of the effects of climate change are global, the causes of climate change are the actions undertaken by the individuals, families, firms and actors at a much smaller scale. [...] To solve climate change in the long run, the day-to-day activities of individuals, families, firms, communities and governments at multiple levels – particularly those in the more developed world – will need to change substantially" (Elinor Ostrom 2009a, 4). For research strategies exploring such global social dilemmas, this entails a significant shift of perspective towards the behaviour of individuals and groups managing critical resource systems on a local scale. For climate-neutral and ecologically resilient post-growth policies, the option to choose a bottom-up approach would skip any excuse for persistent inaction. To solve social dilemmas at the global level it is therefore crucial to understand and first change the determinants of human economic behaviour at the microeconomic level in relation to the socio-ecological context.

As a matter of fact carbon intensity of economic activity is probably a variable dependent on the growth rates of per capita GDP (IPCC Intergovernmental Panel on Climate Change 2014). The extraordinarily high per capita GDP growth rates of the 2000s coincided with the strongest increase of carbon intensity in the same decade. Market income growth, measured as per capita GDP, is thus the most severe risk for the resilience of key global resource systems. The profound entrenchment of the pursuit of economic growth in the institutional setting of current market economies is not easily resolved. However, there appears to be no alternative to a shift to-

wards a post-growth economy to keep human development within the crash barriers of the planetary boundaries (Jeroen van den Bergh and Giorgos Kallis 2012).

It is extremely likely that neither the profit-driven business sector nor the tax-revenue-dependent government sector would emerge as a home of new, growth-ignoring institutions, even if it were possible to shift governance revenues towards a more tax independent financing by profits of state and private enterprises. If this is true, it makes sense to direct the focus of inquiry towards a third sector of not-for-profit economic activities born in civil society (Adalbert Evers and Jean-Louis Laville 2004; Frank Moulaert and Oana Ailenei 2005; Stephen P. Osborne 2008). This third sector could be expected to become the home of new institutional arrangements like cooperatives, multi-stakeholder constructions, local-regional partnerships, and networks. We define the third sector as the sector of not-for-profit enterprises or the civil society sector, situated beyond the business and government sector. It can provide an organisational frame for sustainable development at the local and regional levels. These arrangements could also be considered laboratories for new forms of a more sustainable way to produce, consume, and coordinate these activities beyond the traditional market-government dichotomy. The perspective taken in this research tries to evolve a third option *beyond* this dichotomy and thus, open up the discursive closure that only allows for the two poles of resource governance in society.

This civil society sector embraces a multitude of initiatives, institutional arrangements, and experiments with the microeconomics of a post-growth economy. There is an impressively long history of hands-on urbanism like community gardening and urban agriculture. These initiatives served not only as reactions to crisis situations, avoiding famine, and solving supply bottlenecks in urban areas, but as well as experimental laboratories for an alternative economy on urban green spaces (Christian Borch and Martin Kornberger; Elke Krasny 2012; Christian Borch and Martin Kornberger 2015; Mary Dellenbaugh et al. 2015). Another important civil society movement is formed by the renewable energy source cooperatives, which try to intervene in the transition of the European energy systems towards a low or even zero carbon regime. They organise on local, national, and as well on European level (REScoop.EU - Federation of Groups and Cooperatives of Citizens for Renewable Energy in Europe 2013). The European civil society campaign for a "Right to Water" collected 1,884,790 signatures in the EU countries for the first successful European Citizen Initiative urging that water supply and management of water resources should not be subject to internal market rules and that water services are excluded from liberalisation (Louisa Parks 2014). Finally all of these movements could agree with the insistence that the key resource systems as green spaces, energy, climate, and water should be regarded as commons (Elinor Ostrom 1990; The Ecologist 1994; Ostrom 2009a; David Bollier and Silke Helfrich 2012; Silke Helfrich 2012), and not as traded goods.

We hypothesise: favourable overall institutional conditions, such as a high degree of formal and informal local decision-making autonomy, are supportive for post-growth institutional arrange-

ments, like self-organised and co-operative forms of management of urban common pool resources. This report aims to explore these conditions systematically in the context of socio-ecological transitions with a special focus on the overarching research question: What is the transformative role of institutional diversification and innovation in the governance of core urban common pool resources? Do they pave the way towards a post-growth economy? This research question also implies the aim to find out how the governance of common pool resources in cities could be improved to better contribute to a transition to sustainable development.

### 3. Theoretical background

#### 3.1 An institutional focus for transition analysis

First, we develop a new approach for the analysis of sustainability transitions. For post-growth economics a theoretical framework is required, which allows two things: (1) treating social and ecological systems with almost equal depth, (2) analysing the feedbacks between the resource conditions and the rules determining the harvesting rates of the resource. Aiming to identify the institutional changes necessary to improve the conditions of a more sustainable way to produce and consume inevitably directs the analytical focus to the determinants of these harvesting rules, being the key interfaces between societal and ecological systems. Thus, it is crucial to compare the ecological impact of the available rule sets and at the same time analyse the factors determining the evolution of these rule sets of human resource governance.

Commons are not ordinary goods, as they are construed in the imagination of neoclassical economics (Harry Johnson 1958). From that perspective, the resilience of ecological systems such as the global climate, groundwater basins, lakes, fisheries, forests and so forth, is no good in the sense that people would buy more if they could afford to do so. The post-growth concept of resilience defines the common wealth in the sense that human life depends on the existence of these ecological systems. In contrast to public goods, such common-pool resources are characterised by a high degree of subtractability. Thus, if not constrained, overharvesting may even lead towards a collapse of the overall ecological system. In contrast to private goods, it is highly difficult to exclude potential beneficiaries from using common-pool resources.

For a long time, in standard textbooks it was taken for granted, what Garret Hardin proclaimed in his seminal publication of 1968: “Freedom in a commons brings ruin to all” (Garrett Hardin 1968, 1244). Thus, selling these commons as private property or converting it into public ownership appeared to him as the only reasonable alternatives to avoid such ruin. Historically the “tragedy of the commons” was seen as the inter-temporal problem of securing the fodder of the cattle on common rural ground for the future. Hardin transferred this metaphor in the face of overpopulation – anticipated by him as many others in the 1960s - to the feeding of humans.

In the meantime, modern game theory has found that this class of social dilemmas builds on further assumptions, such as (1) complete and common information, (2) independent and simultaneous decisions, (3) no communication, and (4) no central authority. “When these assumptions are made for a game that is not repeated, or is finitely repeated, the theoretical prediction derived from non-cooperative game theory is unambiguous - zero cooperation” (Ostrom 2009a, 6). But, in contrast to this, many field studies have found that “local groups of resource users [...] have managed to create viable institutional arrangements for coping with common-pool resource problems” (Elinor Ostrom 2005, 221). Thus, it is very promising to explore such self-organised resource governance systems as core of a shift towards a regime of post-growth economics at the local level.

Institutions are defined here as “the prescriptions that humans use to organize all forms of repetitive and structured interactions [...] at all scales” (Ostrom 2005, 3). From this point of view, institutions are the “underlying rules of the game” (Douglass C. North 1990, 4–5). Regarding self-organisation, the following description serves as a starting point for further research: “Self-organized resource-governance systems [...] may be special districts, private associations, or parts of a local government. These are nested in several levels of general purpose governments that also provide civil, equity, as well as criminal courts” (Ostrom 2005, 283). Such resource-governance systems may be run by civil society cooperatives in the energy and housing sectors (Conrad Kunze and Sören Becker 2015), community groups caring for local green spaces, non-governmental organisations intervening into the management of water and other ecological resource systems or non-profit organisations managing urban farming initiatives.

Here, an important distinction between participation and self-organisation has to be made, according to the locus of initiative-taking. Whereas participation “refers to goals set by government bodies on which citizens can exert influence through procedures set by these government regimes themselves [...], self-organisation stands for the actual motives, networks, communities, processes and objectives of citizens themselves, at least initially independent of government policies and detached from participatory planning procedures” (Beitske Boostra and Luuk Boelens 2011, 109). Therefore, in contrast to participation, self-organisation can also emerge without intervention of the local government and even despite of it or citizens can deliberately start it as protest movement against political or administrative action. Self-organisation does not necessarily have to follow the ‘rules of the game’, viz. be organised via established formal institutions, but activities can happen in a more spontaneous, self-managed way.

### 3.2 General model of socio-ecological transition

The socio-ecological systems (SES) framework as presented in Amy R. Poteete, Marco A. Janssen, and Elinor Ostrom (2010a) was an advancement, building on the Institutional Analysis

and Development (IAD) framework developed earlier. The IAD framework focuses on institutions that are guiding social interaction between actors that either negotiate on markets via state laws or are self-organising their interactions (Ostrom 1990). The focus is on functioning of institutional settings in certain governance paradigms. For the self-organising capabilities of local entities, the special functional settings of diverse institutional frames are assessed, since diversification of the institutional framework fosters a wider possibility to solve any shortcomings of the other two paradigms—markets and states—by addressing the diversity of the social structure and its scenarios. More current works zooms into “action arenas” (Ostrom 2005, 15), where the social exchange takes place and is guided by three mayor sets of variables: institutions and rules, characteristics of the community and attributes of the physical environment.

Because this study aims to identify the institutional relations, which are crucial for a socio-ecological transition at the city level, the IAD framework seems to be appropriate for framing the research approach. It can be used for comparisons of the governance of different resource systems in different institutional settings in Europe in this study. The framework thus can be separated into two distinct spheres, the social system, and the environmental system. The perspective focuses reciprocal interactions between the two systems, where the ecological system is perceived – because of missing alternatives - from anthropocentric view (Claudia R. Binder et al. 2013). What is important at this point is an explicit link between this systemic approach and a normative perspective. Although it is foremost an analysis-oriented concept, the description of rules, their emergence, and practical implications describe a grasp on the normative interaction of the two systems.

To capture the institutional dynamics of socio-ecological transition, we assume that these kinds of transitions are driven by learning and norm-adopting individuals. These are capable of (1) developing critical levels of trust that other individuals involved in the governance of the resource systems are reciprocators, (2) developing levels of cooperation, which are necessary for solving social dilemmas like the “tragedy of the commons”, and (3) realising the net benefits of this cooperation (Elinor Ostrom 2009b, Poteete, Janssen, and Ostrom 2010, Chapter 9).

The action situation is a key concept of the framework. It can be used to describe a variety of diverse institutional settings such as markets, families, hierarchies, legislatures, corporations, neighbourhood associations, common-property regimes, and so on. In addition, formal games could be described, analysed and compared as action situations regulated by seven normative elements concerning “participants, positions, actions, outcomes, information, control, and cost/benefit” (Ostrom 2005, 188). We will come back to this later.

Overharvesting of resource systems is very much determined by the microeconomics of the growth regime: “A social dilemma situation in which an individual has no information about who else is involved and makes an anonymous decision relieves many individual participants of the need to follow norms or value outcomes of others. [...] Overharvesting tends to occur when

resource users do not know who is involved, do not have a foundation of trust and reciprocity, cannot communicate, have no established rules, and lack effective monitoring and sanctioning mechanisms” (Amy R. Poteete, Marco A. Janssen, and Elinor Ostrom 2010b, 228). It was possible to identify a set of micro-situational variables in repeated social dilemma experiments by relaxing such restrictive conditions that by definition lead to non-cooperative behaviour. These influence trust and positive outcomes in multiple social dilemmas (Table 1). Therefore they are highly relevant for the microeconomics of the transition towards a post-growth economy.

Table 1: Micro-situational variables influencing trust and the solution of social dilemmas

Positive	Positive, or neutral, or negative impact	Negative
S1 - High marginal per capita return of cooperation	S7 - Size of group	S10 - Heterogeneity in benefits and costs
S2 - Security that contributions will be returned if not sufficient	S8 - Information about the average contribution is made available	
S3 - The reputations of participants are known	S9 - Sanctioning capabilities	
S4 - Longer time horizon		
S5 - Capability to choose to enter or exit from a group		
S6 - Communication is feasible with the full set of participants		

Source: (Poteete, Janssen, and Ostrom 2010b, 229–30)

The broader context could be conceptually modelled as a socio-ecological system (SES), consisting of the variables describing the resource system (RS), the resource units (RU), the governance system (GS) and the users (U), which influence the interactions (I) and outcomes (O) of the action situation. External to this system are the variables of the social, economic, and political settings (S) as well as of the related ecosystems (ECO). Poteete, Janssen, and Ostrom (2010b, 237–38) identified a total of 53 variables describing the overall socio-ecological system, of which twelve variables are particularly relevant for the capabilities of the users to self-organise the governance of the resource system (Table 2).

Table 2: Socio-ecological variables that affect the likelihood of self-organisation

Resources	Governance
<b>System</b> RS3 - Size of the resource system RS5 - Productivity of the system RS5a - Indicators of the productivity of the system RS7 - Predictability of the system dynamics	<b>System</b> GS6a - Local collective choice autonomy
<b>Units</b> RU1 - Resource unit mobility	<b>Users</b> U1 - Number of users U2 - Socio-economic attributes of the users U5 - Leadership / entrepreneurship U6 - Norms / social capital U7 - Knowledge of the SES / mental models U8 - Importance of the resource

Source: Variables extracted from (Poteete, Janssen, and Ostrom 2010b, 237)

The socio-ecological context variables determine the capabilities of the users to self-organise the governance of the resource system, and the micro-situational context variables influence the feasible levels of trust and cooperative solutions in multiple social dilemmas. Both level of variables are probably responsible for the diversification and change of the norms, ruling the action situation under consideration. Thus, they could be of crucial importance to the direction and success of socio-ecological transition. Linkages between the social and ecological dimension of the transition especially occur in the topics of information, boundaries, and decisions, since there a direct alignment takes place between social and ecological system—vice versa. The change of norms represented by this set of rules governing local action situations may be considered the central characteristic of socio-ecological system transitions. Successful norm-adoption could be decisive for approaching higher levels of trust and cooperation, and thus for the success of a self-organised and more sustainable governance of common-pool resources in general.

Thus, this study focuses on the interactions of the three different dimensions of resource system governance. Rules, socio-ecological context variables, and micro-situational context variables are assumed to determine the transition paths from one governance regime to another as an ensemble. For such an examination, the sets of rules regulating the action situation of an SES seem to be the appropriate starting point. They connect the resource system and its units on the one hand and the governance system and its units, the users, on the other. Assuming that these sets of rules define the governance regime of a socio-ecological system and defining transitions “as shifts from one regime to another regime” (Frank W. Geels 2011, 26), implies that any transition could involve a change of at least some of the rules governing the action situation of a socio-ecological system (SES).

Rules—in contrast to norms—could be sanctioned. This means, that breaking of rules results in a kind of regulating response of a specific body that is capable and eligible to sanction. However, the violation of a norm does not imply institutional corrections. The process of norm adoption precedes the transforming of rules, as it is a broader foundation of any rule and sanctioning mechanism. This change of rules might be induced externally by superior governance levels, or internally by learning and norm-adopting individuals who are involved in the local action situation. The internal way of learning and norm-adopting is crucial for a profound transition to strong sustainability, because it influences behaviour patterns in the action situation already before legal changes. Here, norms are considered the transition channels for the negative or positive feedback loops between SES and action situations. This is why they could be stabilised or destabilised by these feedback loops, the latter case urging a transition from one governance regime to another.

As developed in our socio-ecological systems transition model, we assume that, if self-organised and co-operative use of common pool resources emerge, this is due to a complex set of variables and norms. For the analysis, Figure 1 proposes modelling the socio-ecological transition as a sequence of rules set with increasing complexity and dynamics.

1. **Scope rules** affect the very basic issues and time horizon of known outcome variables of the sustainability strategy under consideration.

A commonly agreed understanding of the sustainability transition concept, including an agreement on the priorities of such transitions on the local level and strategies, enhances the possibility to grasp topics and fields the sustainability transition encloses. This tacit knowledge facilitates the initiation of transition processes of the socio-ecological systems towards stronger sustainability, since strategies and approaches refer to the same scope and allow consensual solutions.

2. **Information rules** affect the level of information available to each participant of the considered SES. Thus, they provide the basic precondition for citizens' participation and the possible starting point for developing higher levels of trust and cooperation.

Considering the information rules applied in the local context, the degree of citizen participation in the governance of local resource systems like energy, water, and green spaces might be the higher if better information is available for the citizens.

3. **Pay-off rules** assign awards or sanctions to actions regarding the outcomes, thus defining possible returns and the motivation to implement specific sustainability measures for a multitude of actors.

Another crucial precondition for the initiation of socio-ecological transition processes is the emergence of attractive opportunities to invest in new institutional arrangements, promising a sufficient per capita return for the cooperation of local actors. Investments as well as returns need not necessarily be monetary, but could rather be of other quality, like for instance resources, social acknowledgement or replenishment rates of resource units.

4. **Position rules** determine the actors who are authorised and capable to act, considering reputation gained and the possibilities to sanction by potential actors.

We assume that the existence of a certain degree of leadership, i.e. reputation gained by innovativeness, practical experience and trustworthiness in the urban action arena,

is supportive for local self-organisation of common-pool resources. If these individuals gained a reputation as reciprocators this is particularly helpful for a cooperative approach towards the governance of local socio-ecological systems.

5. **Boundary rules** define criteria and processes for including and excluding actors in socio-ecological systems, the degree of overlap between resource and governance systems, as well as the size and heterogeneity of the actor group.

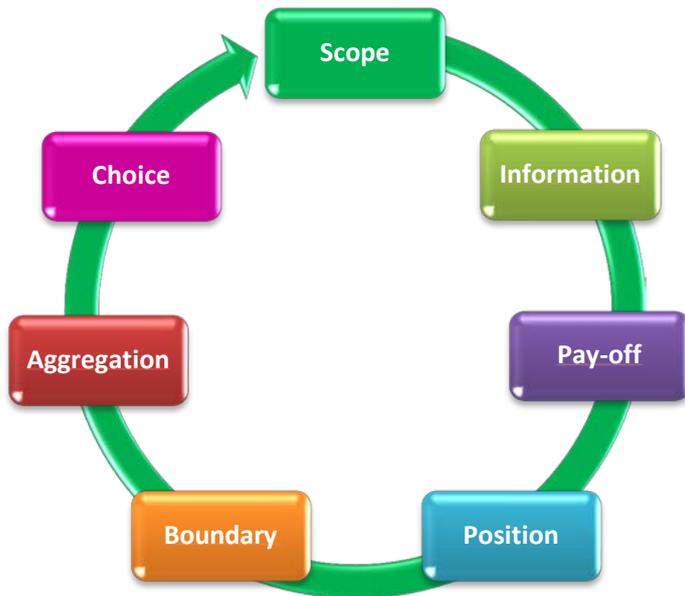
If such eminent people—established as reciprocators and specialists for the local resource system—exist, this will facilitate a kind of norm-adoption in favour of new institutional arrangements and their acceptance by the local citizenship. In the case that the local population accepts such trusted evolution of norms and their sanctioning, this transforms these new norms into rules. The shift of boundary, position, or choice rules thus follows lessons learned in the local action arenas.

6. **Aggregation rules** determine the degree of communication and participation of actors involved in the decision-making on the SES at the considered location. They depend very much on the level of local decision-making autonomy.

If norm-adoption shifted the boundary rules in favour of local action arenas, this could pave the way for a more autonomous decision-making on the local level, leading to a harmonisation of ecological and social boundaries. This implies an enhancement of the local decision-making autonomy.

7. **Choice rules** characterise the extent of power distribution and citizen empowerment in self-organising the governance of local resource systems.

Finally, unambiguous choice or decision-making rules are the most complex indicators of citizen involvement in the governance of local resource systems, either via delegation of power or full-fledged citizen control. We assume that a specific set of choice rules empowers local actors, and is especially productive if this power is distributed equally, to allow a thorough form of self-organisation.



**Figure 1: Socio-ecological systems transition model as a sequence of norm set adoption**

Rather than reading the set of rules in Figure 1 as a cascade, it expresses a process of learning and norm-changes as a helix structure. Rules are altered in a complex and interconnected way. The cycle will repeat itself limitless and regularly reinforce itself.

To this point we have derived seven related assumptions from Ostrom's rule set to guide our research interest that imply a certain mode of influence on critical aspects of the socio-ecological transition process towards sustainability. As a result, these assumptions are compared to a detailed description of the case studies of the resource field. Therefore, it is mandatory to understand the research assumptions as a preliminary interpretation of the field, not as testable hypotheses. From these assumptions, research questions are derived that are indicated an exploratory approach to the field. The strength of the framework lies in its openness to produce explorative insights in the field, which later can be assessed by other scientific means.



**Figure 2: Research questions derived from the SES transition model**

In detail the seven research questions, derived from the seven rules and assumptions, are as follows:

1. Is the urban governance of ecological resource systems observed in the European cities framed by a common understanding of *sustainability transition*?
2. Which kinds of citizen participation and user *self-organisation* can be observed in local urban resource systems like energy, water, and green spaces?
3. Who are the *actors and what factors* motivate them to pursue a socio-ecological transition in these urban resource systems?
4. What are the *lessons learned* and the reputations gained from leadership in local resource management?
5. Could we observe transitional socio-ecological *norm-adoption* towards trust and cooperation in the urban context?
6. Does *local decision-making* autonomy matter in socio-ecological transitions in relation to superior governance levels?
7. To what extent do citizens have an equal voice in the governance of urban resource systems in terms of delegated power and *citizen control*?

Based on the preceding theoretical concept, Figure 2 specifies the connection between the foundational assumptions on the effects of rules and the main direction of the respective research questions.

### 3.3 Research strategy and research design

For the research, a mix of quantitative and qualitative methods appears to be appropriate in addressing the outlined theory. This mix offers a glance at normative shifts, which lead to institutional changes in the sphere of common-pool resource governance. As explained above, it makes sense to focus on the questions of whether, how and in which directions shared strategies, norms, and rules change over time, because norm-adopting behaviour is expected to be the main driver of transformative change. A comparative research design enables the identification of specific institutional settings, external to the urban action arena. These might influence the results of the success or failure of self-organisation and cooperation processes regarding the governance of the local socio-ecological resource systems. Thus, the research considers the following variables:

- in demographic and economic terms: size and growth rates of the city in relation to the country where the city is located regarding population and total GDP
- in geographic and cultural terms regarding the country's location in Northern, Southern, Eastern and Western Europe
- regarding the national government structure as defining the degree of administrative decentralisation and the degrees of local decision-making autonomy
- regarding the welfare regime of the nation, where the city is located as a determinant for the type and degree of heterogeneity of local user groups relevant to the governance of urban common-pool resources.

In the end, a two-phase selection process produced a country selection with 14 countries (12 EU and 2 non-EU). Within these countries, 40 cities were selected according to the set criteria. The sample covers a broad representation of over- and underperforming cities (concerning GDP growth) in the respective countries as well as shrinking to growing cities.

After the selection, the actual field research was conducted by local researchers in the domestic language and later on translated into English. To achieve thorough insight into the local arenas, a quantitative inquiry was conducted as well as qualitative expert interviews with local actors from three distinct sectors (government, business, and civil society). It is thus possible to contrast the empirical reality from the perspective of the experts with a broader assessment of the action arena from the inquiry.

## 4. A brief summary of the results

### 4.1 Diverging priorities ~ income and variety

The results of the survey among local experts in the 40 cities indicated an overall common understanding of sustainability in line with the European Sustainability Strategy (Council of the European Union 2006). However, while the experts in Northern and Western Europe were significantly more concerned with climate change and clean energy, the experts in East and South European cities lay the focus on the management of local water resources and green spaces as well as on the issue of education. The reasons for these diverging priorities are not entirely clear; as potential explanations South Eastern countries' relatively low income levels and the related fact that their policies often follow a shorter time horizon, probably due to their uncertain and vulnerable socio-economic situation, should be considered in the future.

Regarding the energy sector as well as the urban green spaces the interviewees referred to similar sustainability concepts; concerning local water resources the experts highlighted pollution and scarcity as major challenges. In Eastern Europe the overall awareness of the local water system was low, while the weakness of its infrastructure was a major concern in Southern Europe. Despite the high overall priority for 'clean energy', the boundaries of the local energy system were ill defined in terms of exports and imports of different primary energy sources. This indicates a lopsided focus on patterns of energy demand only, while the structure of local energy supply seems to be out of the focus of the experts.

### 4.2 Trade-off between complexity and participation

The field research brought forward a significant trade-off between the complexity of the resource systems considered and the opportunities for the urban citizens to participate in their governance. Regarding the local water system, a misled understanding of participation as 'private monitoring' of volume and quality was observed, while prices for drinking water and the possible privatisation of the local water utilities were considered as social issues with high priority. It was difficult (and even impossible) to create awareness and civic commitment for the invisible, underground part of the aquifer.

In contrast, the resource system of green spaces was considered the outstanding example for civil society involvement and social innovation: here participation and self-organisation emerge more easily and more often than in the governance of water or energy systems. Sometimes civil society actors fought for this right to co-govern the green spaces, sometimes this right was granted to them by the local government. Compared to the other two resource systems, it was much easier for them to get support from local authorities and to become active players in urban governance.

The concepts of participation and self-organisation in the governance of the energy system were highly contested and sometimes problematic. Mostly they were reduced to information provision for the citizens and excluded them from participating in any decision making concerning the provision of electric energy. This could be explained at least partly by the high technological complexity of the energy system and the history of political priorities for more or less centralised and spatially remote systems of electric energy provision, located far off the city limits. Further research on the instruments and institutional settings, which could grant citizens a direct influence on remixing the energy in favour of renewable sources from the supply side, is needed.

### 4.3 Transition – a multi-level endeavour

Our case studies revealed that transition is a multi-level endeavour. This point was particularly stressed by the experts on energy issues: Both the EU and the national level are very much appreciated for providing guidelines, instruments, and financing for fostering the energy transition. Such financial aid and legal frameworks could assist local level actors in pushing forward for the local use of renewable energy sources. In contrast to that, real long-term plans for the local water resources are mostly missing. Awareness for sustainability issues in this resource system is still low; the media coverage here is biased towards pricing of drinking water. Probably this may serve as an explanation for the sensitivity towards privatisation issues concerning local water utilities. Interestingly, regarding the governance of green spaces, local governments are the key actors. This is particularly true if they are advanced in developing their own sustainability strategies. In this case they are mostly ready to allow innovative experiments on public green spaces and to scale them up, if these experiments are successful. To conclude, the complementarity of the different governance levels has to be recognised. This is particularly important for the energy system, because the framework for the energy transition is very much defined on the national level. Yet, at the same time the national level is sometimes prone to service the vested interests of energy providers in favour of fossil or nuclear energy sources. Some saw simultaneous pressure from the European level (in the form of compulsory directives) and the local level as appropriate to break up such corporatist conservatism in favour of new actors, and to overcome such bargaining power in favour of new renewable-friendly institutions. The transfer of knowledge generated by successful experiments with the governance of green spaces into the local provision of renewable energy by model of community energy like for example in the UK (Gill Seyfang, Jung J. Park, and Adrian Smith 2013; United Kingdom, Department of Energy and Climate Change 2014; Kunze and Becker 2015) could enhance the cooperative capital needed for decentral approaches to the energy transition, driven by civil society actors.

#### 4.4 Norm-adoption hard to be observed

In this comparison it was not possible to verify any norm-adoption of local actors concerning their learning out of their sustainability transition experience. Very often the economic concept 'consumer sovereignty' was considered a relevant issue, but a too narrow one simultaneously. Instead the emergence of producer-consumers ("prosumers") is highly needed to care for the complete value chain. It became evident as well that the resources of the local academia are mostly still untapped for informing and guiding urban sustainability transitions. Committed persons, especially in local government but also in the civil society and business sector, are always crucial for pushing ahead such transitions. Whether cooperative capital can be accumulated locally, depends on successful experiments, and their scaling-up. Their success depends on the support of advanced local governments. The EU and national governments are very often needed for legal impulses, legitimising the endeavours of committed local actors. At the same time, these persons ask for simpler and more flexible legal frameworks.

#### 4.5 Institutional diversity

The extent to which citizens have equal access to the governance of urban resource systems in terms of delegated power and citizen control depends on the system's characteristics. Institutional diversity in the sense of self-organisation and citizen participation depends on the tangibility and clarity of the subject, as well as on the governance levels regarded as appropriate.

In the energy system, the main topic is the decentralisation of energy production. New technology must be efficient, but no longer needs to be large-scale and centralised. This technological transition entails an institutional transition. Cooperative, decentralised, and small-scale organisational forms should be further supported and developed. In any case, the urban spatial limitation makes the urban energy system's size larger than the expansion of the city. Cities need to collaborate with neighbouring regions to cover their energy demand. The steering of the energy system is also complex and requires some level of centrality. Smart grids and virtual power plants help to synchronise the production of and demand for energy. Citizen control and delegated power can be complementary in this resource system. Still, the infrastructure needed for energy supply requires a certain amount of centralised control.

The urban green spaces system serves as a good example of emerging institutional arrangements based on self-organisation and citizen control. The high tangibility and the strong local context support citizen involvement. Projects can be realised within a relatively short time horizon, without complex technological requirements and with low financial commitment. Local autonomy is generally given and the cities can create proper legal frameworks. Nevertheless, the municipalities should still assume their responsibility, and privatisation and enclosure should be

avoided. The topic of boundary rules is quite visible here, as entrance to and size of a group play a major role in the capacity to self-organise at the local level.

In the example of the urban water system, the impact of complex technology, long-time horizons of investments and the system's indivisibility lead to strong technological and institutional constraints. Citizens value the 'social aspects' of drinking water supply—such as affordability and access—very highly, but mostly lack the ability and scope to participate in planning processes. Thus, the governance of the resource system is typically delegated to the local, national or European representatives and citizen control plays a minor role. Nevertheless, citizens want their representatives to act in accordance to their needs and use their influence through public opinion formation.

## 5. Conclusion

To conclude, the complementarity of the different governance levels has to be recognised in developing strategies for the transition to any post-growth economy. This is particularly important for the energy system, because the framework for the energy transition is very much defined on the national level, which is sometimes prone to service the vested interests of energy providers in favour of fossil or nuclear energy sources. Thus, pressure from the European level in favour of institutional diversification could help the local level to break up such corporatist conservatism in favour of new actors, and to overcome the bargaining power of the related vested interest in favour of renewable-friendly institutions. The transfer of knowledge generated by successful experiments with community energy like for example in the UK and elsewhere could enhance the cooperative capital needed for decentral approaches to the energy transition, driven by civil society actors. As another result of our research it became apparent, that any strategy for a transition towards a post-growth economy has to consider and to overcome the inherited socio-technological regimes as well. These regimes are still prevailing in the key urban resource systems and interfering with many approaches towards decentralised and self-organised governance of urban commons in many European cities.

Our empirical inquiry and our conducted interviews show that there are individual traits and differences in the several countries and cities as well as convergences. However, a central role for changing institutional arrangements in favour of urban commons lies in degrees of local autonomy, coherent legal frameworks, and activities of civil society. Urban commons in key infrastructures do play a significant role for socio-ecological transitions. However, their part in different resource systems has to be evaluated separately. An in-depth evaluation of the distinct traits of these systems has to consider the several unique dimensions that are entangled with the structural aspects of the resources as well as with the degree, civil society is capable to act.

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