Chapter 17
Lessons Learnt, Open Research Questions and Recommendations

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Abstract This chapter represents the summary of the common analysis within the Interdisciplinary Research Group *Society – Water – Technology*. Lessons learnt, research gaps and recommendations are presented as the outcome of the analysis of the two case studies Fergana Valley and Lower Jordan Basin and as a conclusion from the cross-analysis based on the evaluation framework and the considerations outlined in Chap. 3 (Bismuth et al., Research in two cases studies: (1) Irrigation and land use in the Fergana Valley and (2) Water management in the Lower Jordan Valley. In: Huettl RF,

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17.1 Introduction

The chapters of this book have given an insight into various aspects of major water engineering projects (MWEPs) and the influence of water technologies on societies and natural resources. The key question asked was to which extent MWEPs may support the efficient and sustainable management of water and land resources. Directly linked to this overarching question are reflections on the extent to which such projects generate serious environmental, economic, and social changes, on how MWEPs contribute to the creation of path dependencies and on how such dependencies can be resolved (Moss and Dobner 2015, in this volume). The political component of MWEPs, particularly considerations of the problems related to transboundary water management, has been another important focus.

We have tried to address these questions from two general perspectives: The main aim for the Fergana Valley was to analyse the current and future impacts of the decisions made in the past. For the Lower Jordan Basin and the Red Sea–Dead Sea (RSDS) Conveyance Project, the main goal was to assess future options for action and to determine the conditions for their implementation.

The results from the two case studies do neither allow to draw general conclusions about the complexity of MWEPs nor to simply transfer the results obtained from these two regions to MWEPs globally. Nevertheless, we were able to put the two case studies into a broader context by a comprehensive literature search and to put emphasis on the general political, social and ecological processes associated with such projects. It allowed to identify transferable results and to formulate principal lessons learned from the analysis of these case studies.

For the cross-analysis of the case studies, we also refer to the evaluation framework and the considerations outlined in Chap. 3 (Bismuth et al. 2015a, in this volume). Comparing the two case studies enabled to draw general conclusions and recommendations from four different points of view: (1) from the perspective of international and transboundary water management, (2) from the perspective of the observed planning processes, (3) from institutional and governance-based viewpoints, and finally (4) from the perspective of "coupled socioecological systems".

Before we present this overarching analysis, we want to highlight and summarise the most important findings from both the Fergana Valley and the Lower Jordan Basin.

17.2 The Fergana Valley

As in other regions of Central Asia, the legacy of Russian colonisation and the Soviet Union has had a significant influence on the current water and irrigation management system in the Fergana Valley. This also applies to the ways decisions are made and the present political systems, economies and societies in the region are shaped. MWEPs, i.e. irrigation infrastructures, have led to path dependencies. This legacy

determines the range of action available to the Central Asian countries and shapes the quality and nature of their mutual relations to a large extent. Both the formal and informal political, societal and administrative structures that exist currently can be regarded as a result of past decisions, and the irrigations systems inherited define the options in agricultural cultivation. The transition from former Soviet structures to a market-oriented economy has been slow, and the spirit of the past system controls many decision-making regulations (Kreutzmann 2015, in this volume). Irrigation cycles and drainage systems are oriented towards the cultivation of a limited number of crops, while political guidelines have created a parallel system of "state crops" and "secondary crops", offering only a limited degree of freedom to farmers.

The role of farmers in Uzbekistan – particularly with regard to informal institutions or their stake in the water users associations (WUAs) and the newly formed water users groups (WUGs) – is a key component to understanding the complexity of the socio-agricultural system (Moss and Hamidov 2015, in this volume). The WUAs, for example, are caught between two powerful state-driven institutional regimes: agriculture and irrigation. They lack a supportive institutional environment as well as the necessary resources and the financial and personal capacities needed to efficiently run and maintain the present infrastructure. In order to increase their effectiveness, it would be necessary to analyse existing funding sources for irrigation services and to ascertain how revenues from the agro-hydrological systems could be distributed more equally to enhance the capacities of the farmers and the WUAs. At the same time farmers should be given more discretionary powers to enable them to decide independently on resource use (which crops to plant, how much water to use, when to use water, etc.) which could be achieved by increasing their participatory power in the WUAs and WUGs (Hansjürgens 2015, in this volume).

17.3 The Lower Jordan Basin

One of the arguments brought up in favour of the RSDS Conveyance Project is that the project could be a vector for peace in the region. Therefore, our focus has been on the relations between the riparian states of the Lower Jordan Basin and on the institutional settings (legal provisions, power constellations, informal norms, etc.). The relations between the riparian states are central for medium- and long-term water security (Yorke 2015, in this volume, pp. 227–251). The asymmetry of powers and the deeply rooted mistrust between the parties involved, a result of the Israeli occupation of the West Bank and also of institutional fragmentation within the Palestine Territories and the Kingdom of Jordan, weakens the capacities of actors concerned to develop comprehensive strategies for sharing management of the water resources available (Bismuth 2015, in this volume).

One of the intriguing aspects of the RSDS Project is that alternatives were given serious attention, albeit belatedly. This suggests a learning process going beyond the conventional single-project debate. But the political background and the power asymmetries in the region impede the attainment of nonconventional, less techni-

cally orientated measures to prevent further decline of the Dead Sea. Other aspects, such as the technical feasibility to produce energy with saline water, have not been taken into account from the beginning.

Particularly in Jordan, the interests of vested groups work against the implementation of transformative political and administrative reforms (Yorke 2013). International donors can even be regarded as being complicit in these outcomes, since their funding of aid projects and budgets also underpinned state largesse from which these groups benefitted in the past (Yorke 2015, in this volume, pp. 227–251). Therefore, the future role of the international donor community should be evaluated critically, and their policies should match a common development strategy with projects and funds being fairly distributed among riparian states. Specific competences and duties should be assigned to each riparian according to their capacities, thus avoiding inconsistencies and enhancing efficiency.

Jordan in principle has a strong incentive to reap the benefits of improved regional cooperation. But a platform for such regional cooperation in the region is missing. It could be the role of international donor organisations particularly in the light of the planned RSDS Conveyance Project to provide such a platform for mutual exchange as a means of trust building, to enhance transparency of the decision-making process and to provide reliable databases about water resource availability and water distribution. At present, any advances in this direction have been blocked by the failing Israeli-Palestinian "peace process".

The influence of an "ideological narrative" rather than economic considerations on agricultural planning is particularly evident in the Middle East. In some parts of the Jordan Basin, giving up agricultural cultivation entirely or switching back to dryland agriculture in favour of ecological rehabilitation projects could even create win-win situations, especially where the contribution of agriculture to the state economy is minor. Research in enhancing productivity of dryland agriculture should therefore be intensified (Bismuth et al. 2015b, in this volume). Also, the role of "virtual water trade" in the resource strategies of the countries and its effect on the economies, revenues and trade balances still need further research. The same applies to the effects of global food shortages and price hikes.

17.4 Cross-Analysis of the Case Studies

Despite significant differences and varying framework conditions between the two case studies, we believe that it is exactly due to these variations in water management and water governance structures that allow us to define overarching trends regarding the management of MWEPs, to formulate open research questions and to derive options for action.

Even though cultures, societies, historical backgrounds and political and economic systems differ considerably between the two case studies, they show some striking parallels:

In both regions, MWEPs have been regarded as essential elements for economic development. We realise that it has not necessarily been technical failure that has led to the observed ecological and social problems in the respective countries, but rather the inadequate or even absent interaction between technical specifications and societal processes. Apart from infrastructure and human and institutional resources, MWEPs also require arrangements which do not serve only selected groups of users or beneficiaries. It needs political processes to introduce, coordinate and establish adequate governance rules in order to run these social-technical-environmental systems effectively (Dobner and Frede 2015, in this volume).

Our analyses of the situation in both regions have shown that transformation processes in water management have been slow and insufficient, even under generally favourable conditions. Transformation of water management institutions does not hold pace with the societal and environmental changes. As a consequence, the Aral Sea has already been given up, and the Dead Sea is threatened by the same fate.

Decision-making has been ad hoc and partial, too often guided by merely technocratic approaches and aimed at overcoming either economic or resource-based deficiencies. Decisions have often served the interests of influential interest groups and have supported neo-patrimonial structures (Sehring 2009; Yorke 2013). The processes have been organised in centralised and highly hierarchical structures dominated by a "hydro-scientific elite". This corresponds with the observations described by Molle et al. (2009) in their study on hydraulic bureaucracies and missions.

According to the four different perspectives on MWEPs, as described above, we can formulate the following key recommendations for action:

1. Strengthening coordination and cooperation among riparian states
2. Enhancing planning processes and decision-support tools
3. Improving responsiveness and responsibility of institutions and governance structures for MWEPs
4. Taking into account systemic feedbacks and contingent contexts of coupled systems

17.4.1 Strengthening International Coordination and Cooperation Around MWEPs

An analysis of international agreements concerning the management of shared water resources in the two case studies has revealed that they are inflexible concerning changing environments and societal developments, generally lacking a basin-wide approach. Explicit rules for cooperation, adaptation and conflict mitigation are missing, which is a key reason why they fall short.

In addition, the failure of transboundary initiatives is the consequence of an unequal distribution of costs and benefits among riparian states as well as among

the various stakeholders within each country. Such asymmetrical relations may considerably hinder the development of transboundary initiatives and agreements. Indeed, one of the fundamental principles of international water law, the equitable utilisation of resources, is frequently violated.

Lim (2014) postulates the identification of multi-resource linkages in the negotiation of international water agreements as a means to increase the number of potential win-win solutions. This so-called "shared benefit model" promotes the identification of benefits of transboundary cooperation that accrue across sectors (e.g. the water sector, agricultural sector, trade sector).

To optimise the management of MWEPs in a transboundary context, it is necessary to improve the coordination and cooperation among riparian states. Important guidelines on how to improve coordination and cooperation in transboundary water management can be found in the so-called "Berlin Rules" developed by the International Law Association (International Law Association 2004). The authors of these rules set out criteria for determining an equitable and reasonable use of water and also for the consideration of the physical and geographical characteristics of the watercourse. While the acceptance of these rules might not be binding for riparian states when bargaining about MWEPs' benefits and cost sharing, international donors, who are in many cases involved in MWEPs, could place more emphasis on the implementation of the Berlin Rules.

The overarching goal of improved cooperation and coordination can be achieved by the following activities:

- Integrating transparent monitoring, evaluation and conflict resolution mechanisms into transboundary agreements
- Harmonising different national rules within a transboundary management area
- Integrating resource allocation methods, which are adaptive to changing environments and societies, as well to new predicaments
- Identifying benefits and costs of transboundary cooperation and trying to establish win-win solutions

It is important to understand that general objectives need to be broken down into practical, reliable and concrete milestones. Research efforts are needed both for the development of adaptive strategies (goals, procedures, strategies) and for the transformation of institutions, preferably achievable in a step-by-step approach. This has to go hand in hand with the development of monitoring and evaluation criteria as they play a critical role in adaptive management structures determining whether standards have been met or more interventions are needed (Lim 2014). A comprehensive analysis of present transboundary treaties and conventions as well as their success factors and failures would be a first step towards the development of adaptive strategies (see, e.g. Dombrowsky 2007).

17.4.2 Enhancing Planning Processes and Evaluation Tools for MWEPs

In the past, the benefits of MWEPs have been mostly overestimated, while the costs have been underestimated (Flyvbjerg 2007, 2012; Ansar et al. 2014). A comprehensive and integrative planning approach may help to improve the sustainability of water resource management. It incorporates the search for alternatives, the adjustment of the plans to technical innovations and the application of transparent auditing and planning procedures. MWEPs as technical structures are always simultaneously embedded into contextual societal and economic frameworks. The planning process should include options for dealing with situations in which – due to uncertain costs and/or benefits – high burdens on a nation's state budget can emerge. The use of economic cost-benefit analysis (CBA) or multi-criteria analysis (MCA) based on a comprehensive understanding of values (e.g. the total economic value, TEV, framework) may provide overarching analytical tools to assess changes in values due to large-scale investments (Young and Loomis 2014). Involved parties should ensure that they have sufficient resources to finance the project, either within the present generation or with acceptable burdens on future generations.

Regarding the planning process of MWEPs, it is also important to evaluate not only the financial but also the legal, institutional and societal capacities right from the outset. Legal instruments, formal and informal institutions and implementation strategies (e.g. the existence of an effective revenue system, the inhabitants' tax mentality, the effectiveness of governance structures) should match available resources at each level of authority and address the needs of the stakeholders (Lim 2014). Designing regulation and a decision-making process should take into account specific locations of capture and weak capacity and to improve the existing infrastructure (Faure et al. 2010).

We highlight the following essentials that a planning process for MWEPs should include:

- Developing alternatives, including the "no-action" alternative and exit strategies
- Drawing up a flawless set of rules for assessing and evaluating MWEPs and a transparent planning process
- Using appropriate decision-support tools such as CBA and MCA within the planning and evaluation process
- Analysing the economic, institutional and societal capacities to assure the sustainability of the project
- Clearly distinguishing between the planning and implementation process in order to minimise the risk of appropriation by vested interests
- Independent controlling accompanying the planning process
- Comparing MWEPs with successful reference systems

Even though planners do have a number of instruments available, there still appears to be insufficient information and knowledge on the complexity and interdependency of ecosystems and the values and services they generate for certain vulnerable groups (Hansjürgens et al. 2015, in this volume). In particular, we lack a comprehensive approach to cost-benefit analysis that includes an integrated instrument assessing all stakeholders and all values affected. In an ideal case, such an instrument would be able to integrate the knowledge of planners and of natural, technical and social sciences and of humanities and societal stakeholders in one integrative process of decision-making. Research on cross-sectorial planning – i.e. ways of connecting water management planning, infrastructure planning and urban planning – is highly desirable in this context.

17.4.3 Improving Responsiveness and Responsibility of Institutions and Governance Structures for MWEPs

Many formal institutions in fragile or failing states (e.g. legislation) lack effective backing and therefore remain ineffective. By contrast, non-codified customs and practices of established elites can remain powerful behind the scene. Building capacities is an important strategy to address weak formal institutions. Institutions should be in accordance with the capacity of the governmental and the economic systems (Lim 2014; Dobner and Frede 2015, in this volume). Designing regulations and a decision-making process should take into account the capacities and the powers of the addressed institutions and improve and optimise the existing infrastructure (Faure et al. 2010).

In the context of fragile or failing states, it is particularly important to also consider the existing institutional strengths that are available. In the past some of the institutional reforms towards liberalisation and decentralisation have undermined already existing, although weak, institutions. In this regard, international donor policy has a specific obligation. Better coordination and harmonisation of donor policy with overarching objectives and international regulations are needed.

Transforming water management institutions is a time-consuming and complex process. The introduction of economic instruments such as water pricing alone will not be sufficient for a successful transformation (Hansjürgens 2015, in this volume). Efficiency and economic performance are linked to the existence of inclusive institutions (Acemoglu and Robinson 2012). Economic instruments have to be designed properly. They have to consider aspects of calculation and distribution of costs among users, metering and monitoring water use and strong governance structures including social participation and social equitability. Transparency, trust and public participation in decision-making procedures from the beginning are important assets of inclusive institutions. Admission to financing and banking systems and access to markets and market information, specifically for farmers, should also be considered within the transformation process. Institutional reform can thus support economic and social development by creating opportunities for rural populations.

The formation of inclusive institutions requires commitment both from the authorities and the civil society. Such institutions also need sufficient financial resources and capacities to be able to play a beneficial role in water management. Structures (e.g. water users associations) have to be adapted to the specific local context. A polycentric model (the "bazaar"), in which various organisational forms coexist, may prove more suitable than a hierarchical one, particularly in situations characterised by little reliable data, highly variable water supply and demand and under-resourced regulatory agencies (Lankford and Hepworth 2010).

Institutional learning has to be backed by close cooperation between research and education. Technical schools, experimental farms and training courses for practitioners can be named as important instruments for transferring knowledge within institutional learning processes. Scientific and educational institutions themselves have to adapt to new requirements arising from increasing complexity of coupled systems. New communication instruments need to be developed to enhance the citizen-science dialogue.

The following activities can be regarded as critical in designing and adapting institutional arrangements:

- Fostering institutional development in accordance with governmental, societal and economical capacities
- Harmonising and coordinating donor policy with overarching objectives and international regulations
- Strengthening inclusive institutions that take all stakeholder interests into account
- Supporting participation processes, transparency and trust-building measures
- Applying the "polluter pay's principle" as far as it is economically and politically feasible
- Linking research and education with practice

National institutional reform and adaptation can only be effective in the context of supportive international development policy. In the past, mainly international donor organisations such as the European Development Bank or the World Bank have granted loans for investments to MWEPs. Recently, we are observing the emergence of other actors, such as certain countries that finance infrastructures (e.g. China) or private financing institutions independent from international conventions, regulation schemes and standards. Decision-makers mostly welcome these new investors without assessing in depth the societal, economical or environmental consequences of the planned investments. This development is a new challenge not only for the societies in the concerned regions but also for the international community as such.

17.4.4 MWEPs as Coupled Technical-Social-Environmental Systems

Technical solutions such as MWEPs are attractive for decision-makers because they promise high gains, which can be harvested in manageable timescales. Benefits can be expected within a short period after the construction phase is completed. This is in contrast to institutional transformation processes, which usually require longer planning, longer implementation and longer evaluation phases. Commonly overlooked when planning MWEPs are not only often "neglected values" like ecosystem and societal impacts but also their systemic rebound effects, their irreversibility and their effects on coupled systems. Coupled systems are characterised by high-complexity and self-organising structures leading to emergent phenomena. Such self-organising structures are illustrated by new system properties, which cannot be understood from the properties of the single component (Helbing 2014). Not only in socio-economic systems but also in ecosystems, complexity leads to emerging systemic risks. Especially in conditions of uncertainty, incomplete information or even a basic lack of knowledge, one has to be aware of the fragility of complex (eco)systems. Furthermore, MWEPs create path dependencies, which limit the available range of choices for future generations, and therefore pose ethical questions. On the other hand we can use the self-organising, adaptive nature of the coupled systems to reach favourable system behaviours, which are robust to external disruptions and align to changing conditions (Helbing 2010).

From the perspective of coupled systems, the planning, regulation and use of MWEPs should respect the following:

- Considering not only aspects of uncertainty (where probabilities can be defined), but a lack of knowledge
- Applying the precautionary principle
- Developing alternatives especially in the case of contingent events
- Using modelling tools (e.g. agent-based modelling) and analytical tools (e.g. network analysis) that explicitly address complexity
- Establishing favourable system attributes, which are robust to external disruptions and adaptive to changing conditions

Further research is needed to develop methods, models, tools and decision-support systems for coupled systems, which have stochastic characteristics. We underline the necessity for an interdisciplinary research approach to answer the pressing questions of a complex world.

17.4.5 Concluding Remarks

MWEPs are characterised by properties that exceed those of "normal" infrastructure projects not only quantitatively (by their mere size) but also qualitatively (by adding entirely new dimensions to an infrastructure project). MWEPs are complex investments that encompass not only technical but also societal, ecological and institutional dimensions. This complexity requires an understanding of the collective dynamics driving it. The answer cannot be technological approaches alone. Many crises occur because we are unable to understand the dynamics of such systems. There is a gap between problems and solutions. It is our task as researchers to reduce this gap, to develop new tools to address the complexity of systems and to provide knowledge for decision-makers regarding the behaviour and management of complex systems. But we have also to reflect whether we use the right approaches to understand these interrelated complexities, whether we derive fitting recommendations or action and whether we communicate them accordingly. In a citizen-science dialogue, we might find the first promising answers – but we should go further. The role of research is to raise understanding of complex processes, to query underlying assumptions, to uncover inconsistencies, to raise alternative options, to map out potential futures and to broaden perspectives. In these ways researchers would not just be providing new (specialist) knowledge but engaging with political debates and seeking ways of informing these.

We have to invest not only in the development of new technologies, which can reconcile environmental necessities with our human needs, but also in the capacities of our societies and our institutions to deal with growing complexities. We can no longer ignore the social dimensions of our decisions nor the increasing disparities between our societies. We need adaptive and resilient societies, based on transparency and humanistic values. In planning MWEPs we have to start now, as their lifespan far exceeds the lifetime of single human generations.

References

Acemoglu D, Robinson J (2012) Why nations fail: FBBVA lecture

Ansar A, Flyvbjerg B, Budzier A, Lunn D (2014) Should we build more large dams ? The actual costs of hydropower megaproject development. Energy Policy 69:1–14

Bismuth C (2015) Cooperation and power asymmetries in the water management of the Lower Jordan Valley – the situation today and the path that has led there. In: Huettl RF, Bens O, Bismuth C, Hoechstetter S (eds) Society – water – technology: a critical appraisal of major water engineering projects. Springer, Dordrecht, pp 189–204

Bismuth C, Hoechstetter S, Bens O (2015a) Research in two cases studies: (1) Irrigation and land use in the Fergana Valley and (2) Water management in the Lower Jordan Valley. In: Huettl RF,

Bens O, Bismuth C, Hoechstetter S (eds) Society water technology: a critical appraisal of major water engineering projects. Springer, Dordrecht, pp 89–98

Bismuth C, Hansjürgens B, Yaari I (2015b) Technologies, incentives and cost recovery: is there an Israeli role model? In: Huettl RF, Bens O, Bismuth C, Hoechstetter S (eds) Society – water – technology: a critical appraisal of major water engineering projects. Springer, Dordrecht, pp 253–275

Dobner P, Frede H-G (2015) Water governance: a systemic approach. In: Huettl RF, Bens O, Bismuth C, Hoechstetter S (eds) Society – water – technology: a critical appraisal of major water engineering projects. Springer, Dordrecht, pp 79–87

Dombrowsky I (2007) Conflict, cooperation and institutions in international water management – an economic analysis. Edward Elgar, Cheltenham

Faure J-M, Goodwin MEA, Weber F (2010) Bucking the Kuznets curve: designing effective environmental regulation in developing countries. Virginia J Int Law 51:95–156

Flyvbjerg B (2007) Policy and planning for large-infrastructure projects: problems, causes, cures. Environ Plan B Plan Design 34:578–597. doi:10.1068/b32111

Flyvbjerg B (2012) Why mass media matter to planning research: the case of megaprojects. J Plan Educ Res 32:169–181. doi:10.1177/0739456X12441950

Moss T, Hamidov, A (2015) Where water meets agriculture: the ambivalent role of the water users associations (WUAs). In: Huettl RF, Bens O, Bismuth C, Hoechstetter S (eds) Society – water – technology: a critical appraisal of major water engineering projects. Springer, Dordrecht, pp 149–167

Hansjürgens B (2015) Theory, market and the state: agricultural reforms in post socialist Uzbekistan between economic incentives and institutional obstacles. In: Huettl RF, Bens O, Bismuth C, Hoechstetter S (eds) Society – water – technology: a critical appraisal of major water engineering projects. Springer Berlin, Dordrecht, pp 169–186

Hansjürgens B, Droste N, Tockner K (2015) Neglected values of major water engineering projects: ecosystem services, social impacts and economic valuation. In: Huettl RF, Bens O, Bismuth C, Hoechstetter S (eds) Society – water – technology: a critical appraisal of major water engineering projects. Springer, Dordrecht, pp 65–78

Helbing D (2014) Complexity time bomb – when systems get out of control. Chapter 2 of Digital Society, forthcoming. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2502559. Accessed 10 Apr 2015

Helbing D (2010) Systemic risks in society and economics. International Risk Governance Council (irgc). http://irgc.org/IMG/pdf/Systemic_Risks_Helbing2.pdf. Accessed 10 Apr 2015

International Law Association (2004) Water resources law. Berlin conference. http://international-waterlaw.org/documents/intldocs/ILA_Berlin_Rules-2004.pdf. Accessed 10 Apr 2015

Kreutzmann H (2015) From upscaling to rescaling – The Fergana Basin's transformation from Tsarist irrigation to water management for an independent Uzbekistan. In: Huettl RF, Bens O, Bismuth C, Hoechstetter S (eds) Society – water – technology: a critical appraisal of major water engineering projects. Springer, Dordrecht, pp 113–127

Lankford B, Hepworth N (2010) The cathedral and the bazaar: monocentric and polycentric river basin management. Water Alternat 3:82–101

Lim M (2014) Is water different from biodiversity? Governance criteria for the effective management of transboundary resources. Rev Eur Comp Int Environ Law 23:96–110. doi:10.1111/reel.12072

Molle F, Mollinga PP, Wester P (2009) Hydraulic Bureaucracies and the hydraulic mission: flows of water, flows of power. Water Alternat 2:328–349

Moss T, Dobner P (2015) Between multiple transformations and systemic path dependencies. In: Huettl RF, Bens O, Bismuth C, Hoechstetter S (eds) Society – water – technology: a critical appraisal of major water engineering projects. Springer, Dordrecht, pp 101–111

Sehring J (2009) The politics of water institutional reform in neopatrimonial states. Springer, Wiesbaden

Yorke V (2013) Politics matter: Jordan's path to water security lies through political reforms and regional cooperation. NCRR Trade Regulation, University of Bern, Bern

Yorke V (2015) Jordan's shadow state and water management: prospects for water security will depend on politics and regional cooperation. In: Huettl RF, Bens O, Bismuth C, Hoechstetter S (eds) Society – water – technology: a critical appraisal of major water engineering projects. Springer, Dordrecht, pp 227–251

Young RA, Loomis JB (2014) Determining the economic value of water: concepts and methods. Taylor and Francis, New York