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Practical Planning Management of WEF-Nexus Issues in Germany

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LIST OF ABBREVIATIONS

EU	European Union
ICPR	International Commission for the Protection of the Rhine
PSP	Pumped-storage plant
RPP	Regional Planning Procedure
UNECE	United Nations Economic Commission for Europe
WEF-Nexus	Water-energy-food Nexus

1. BACKGROUND AND OBJECTIVES OF THE REPORT

The growing world population and increasing need for food, drinking water, hygiene and energy is generating a constantly increasing pressure on land and water resources, as well as (fossil) energy sources and their connected greenhouse gases. The interdependencies are complex, and increasingly prone to conflicts due to scarcity or overuse. National regulatory frameworks are generally assumed to be a weak mechanism for resolving land and water use conflicts. Sectoral control mechanisms are often more powerful than solutions that are integrated and balance interests. As a result, the potential for conflict is increasing in many locations, particularly due to local, regional and global resource shortfalls, climate change impacts and an increasing pressure to utilise available resources.

Water, energy and food issues can no longer be separately addressed in development cooperation. The Nexus approach analyses the connections and interdependencies, increases awareness in local and global politics, and develops implementation expertise to address externalities. The Nexus approach highlights the weighting of requirements as well as compensation and incentive mechanisms (also in consumer behaviour). The standard Nexus approach is based on the interactions between social human rights (drinking water, hygiene and food), environmental sustainability and economic development for disadvantaged populations. Therefore, the environmental and urban sectors are also target groups for the Nexus approach.

The Nexus approach modelled in the context of development cooperation should be increasingly implemented in practice, however the relevant requirements of sectoral policy continue to govern practice. The objective of the approach is that the design of sectoral policies and their relationships with each other (Nexus) reflect the demands owing to resource scarcity and resource governance. “Effective Nexus governance reduces negative intersectoral effects through a mix of feasible and socially acceptable instruments” (Dombrowsky et. al, 2016).

Since the Bonn 2011 Nexus Conference, GIZ has been involved in the further development of this approach, on behalf of the Federal Ministry for Economic Cooperation and Development. The European Commission also launched a Nexus programme in 2015 (“Regional Nexus Dialogues Phase 1”). In January 2016, the Directorate-General for International Cooperation and Development, together with the Federal Ministry for Economic Cooperation and Development, started sponsoring a three-year sectoral project (“International Water Policy”), which is affiliated with the Nexus project “Global Nexus Administration”. This project manages existing and new regional Nexus policy dialogues, in cooperation with partner organisations and regional GIZ projects. In addition, the existing online platform will be expanded to become a Nexus knowledge hub.

Experiences with the cross-sectoral balancing of interests for use in the Nexus approach

In Germany, the task of regional planning is “...to coordinate varying spatial requirements and to settle conflicts that arise at the respective planning level...” (§1 (1) ROG). The vision is to bring to harmony between “...the social and economic requirements with their ecological functions and to contribute to a permanent, large-scale and balanced system, with equivalent living conditions in all sub-regions ...” (§1 (1) ROG). A number of instruments and procedures are used for this purpose, which disclose intersectoral concerns and interests, evaluate conflicts and impacts, ensure the basic requirements for living conditions, and thus should

balance, social, economic, environmental and other subject-specific interests. The instruments and procedures have been regulated by law and tested for decades in Germany, and they have generally proved to function effectively.

It should be noted that some experiences gained from the use of these mechanisms could be of great value in the further development and practical implementation of the Nexus approach. The objectives of the study are to identify situations relevant to the water-energy-food Nexus (WEF-Nexus) issue in Germany from available processes, and to describe the implementation and relevant experiences based on three examples with strong Nexus orientations. The study focuses on practical planning and application using suitable instruments. At the core of the study is the consideration of experiences gained in the practical application of procedures and instruments in connection with WEF-Nexus issues, and their general transferability to Nexus governance strategies.

The results of the study are expected to serve as a frame of reference in the consulting and advanced training for the GIZ project “Nexus Regional Dialogues”. This study will be complemented by a closely aligned study, developed in parallel, and investigating the framework setting for WEF-Nexus issues in Europe.

2. FUNDAMENTALS AND INVESTIGATIVE APPROACH

2.1 Nexus Approaches in German Planning Practice

Significant spatial projects are generally planned and implemented because of sectoral interests or a sectoral need. Sectoral plans (or technical plans) are classified as “interfering” (eg. mining, energy, transport, hydraulic engineering) or “protecting” (eg. nature conservation, soil protection, water protection), according to their impact on people and nature. A sectoral planning law in Germany grants different sectors the rights to specific land use permissions which they need to implement projects (eg. nature reserves). This can be achieved either directly by the project sponsor, through application of this planning law, or with the help of the authorities responsible for the plan approval. Landowners are forced to follow these regulations, which may result in them being compensated for disadvantages or even expropriated. There are currently 25 specialised projects with particular “land rights”; some for energy production, mining, energy service lines or inter-urban roads. The responsible bodies (public planning authorities) are to participate with land use planning and spatial planning procedures, and their concerns are to be taken into account (cf. §§ 1, 5, 7 BauGB, §§ 2, 5 und 7 ROG). The interdisciplinary spatial planning (urban development planning and spatial planning procedures) sets plans for other parties, the specialist plans for themselves and for the individual project sponsors.

Handling conflicts of interest is at the centre of regional planning. Conflicts always arise with significant spatial planning in areas with thorough use (and thus generally everywhere in Germany), as both specialist planners and spatial planners believe that their concerns are of higher priority. This requires clear “priority rules”, which exist in the German legal system. The priority rules state that specialist planning of transregional significance is prioritised against local urban development planning (§§ 7 and 38 BauGB), though municipal interests must still be considered. It is then ensured that the spatial and overall planning can assume its superordinate, cross-sectional, diverse spatial demand coordinating and conflict-resolving role. This is carried out by assigning or excluding routes and regions

for priority or reservation according to the classification of the location itself as spatially significant (development, regulation, security and provisional orders according to § 1 Abs. ROG).

The principles of regional planning and their instruments are in principle a governance framework, which is very similar to the aspirations of the Nexus approach:

- Making relevant sectoral interests transparent.
- Disclosing the interests of both relevant and low-key actors.
- Determining and evaluating sectoral and intersectoral impacts.
- Making information for all involved parties accessible and in the same form.
- Balance interests and create potential for optimisation where possible.
- Ensure compliance with minimum requirements (based on legal requirements or aided by experts).
- Assess and evaluate concerns according to overall social standards.
- Make reliable decisions about necessary measures and actions.

Using these principles and the tasks of regional planning, it is evident that there is a large congruency to Nexus approaches. It is also clear that in this context, numerous governance requirements must be transferable.

2.1.1 Selected Instruments Relevant to Nexus

Environmental and regional planning policy instruments are typically based on a mix of regulatory, economic and discursive instruments.

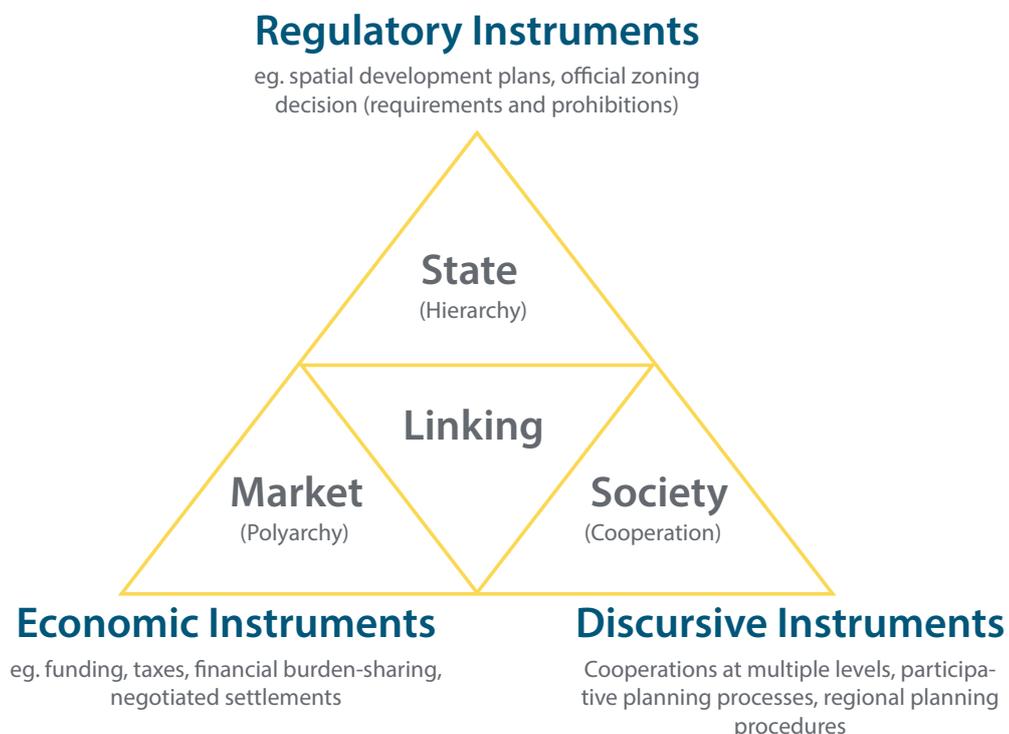


Figure 1: Categorisation of environmental and regional planning policy (Heiland 2002, amended)

In Germany, these instruments are generally combined within the planning approach. For all processes in which conflicts of interest are to be resolved, a suitable mix of instruments must be found that will:

- a) Comply with minimum standards or prevent deterioration (in particular regulatory instruments).
- b) Ensure compliance with rules and regulations (without regulatory measures being too extensive).
- c) Create and preserve political and social peace, and raise the general acceptance of compromise solutions in order to enable a compromise to occur (economic and discursive instruments).

Relevant instruments from these criteria are briefly presented in the following sections.

Spatial Development Plan

The spatial development plan is the central planning instrument for regional and state planning. It specifies the possibilities and limitations for the use of space in particular areas. In doing this, both sectoral and community interests are introduced, integrated, considered and coordinated. Spatial development plans consist of a variety of types and categories of plans (eg. state development plans or regional plans). The states are obligated to establish spatial development plans, in accordance with the Spatial Planning Law. A central element of spatial development planning is the “counter current principle”, which prescribes the combination of top-down (hierarchical planning) and bottom-up (local or private interests) approaches. An important principle of the planning process is the involvement of all sectors, communities and public interest parties. At the start of this process, all parties are given the same importance and access to information.

Regional Planning Procedure

In a regional planning procedure, spatially significant plans and measures are coordinated with each other and also with the requirements of regional planning. The land use impact of a plan or measure is assessed in a regional procedure. Other investigated points are:

- Whether spatially significant plans and measures conform to regional planning requirements.
- How spatially significant plans and measures can be coordinated or carried out under the considerations of regional planning (spatial impact assessment).

Through a legislative decree and with consent from the Federal Council, the federal government has defined for which plans and measures a regional planning procedure ought to be carried out: they should be carried out if they are spatially significant and have regional significance. In the spatial impact assessment with an integrated environmental impact assessment, all relevant concerns must be set out, investigated, weighted and assessed in the same way. All concerned public actors are involved equally in the regional planning procedure and receive access to all information important in decision making.

Environmental Assessments

Environmental assessments serve to specifically investigate and evaluate the environmental effects of projects, plans or programmes. Early in the planning process, they help to identify possible environmental consequences of a project, and explicitly take these into account when making decisions on whether the project will be carried out. They provide the basis for the environmental impact assessment and the strategic environmental assessment. Transparency of the evaluations and decisions should be ensured due to the mandatory inclusion of relevant authorities and the public. One of the aims of environmental assessments is to protect human health and the natural environment from foreseeable adverse effects of planned projects. Furthermore, environmental assessments should contribute to the acceptance of the project in question, by means of improving transparency and public involvement in the decision-making process. The wider acceptance of the project should provide the project sponsors with planning security.

Organisational Models / Forms of Cooperation

The existence of a cooperation platform for parties with competing interests is a prerequisite for the initiation and success of negotiations, compromises, as well as economic and contractual solutions. Formalised cooperation allows discourse and long-lasting arrangements regarding contributions from various conflicting parties, so that they can work towards joint solutions and the realisation of synergy potential. Examples and analyses of this are extensive and relate to small-scale, regional and national conflicts. Independent from the variety of different requirements of successful cooperation models, some fundamental principles are identified as factors in success. These are, for example, transparency of information and negotiations, economic symmetries, confidence-building measures and recognisable benefits for all partners.

Economic Instruments

Economic instruments are of utmost importance in enabling a balance between sometimes non-naturally balanced environmental actors. These include financial incentives (positive or negative) or the creation of market conditions in which natural or environmental resources are produced and demanded by private actors.

There are various ways to classify economic instruments. Some examples are:

- Positive and negative financial incentives / remunerating environmental services / payment for ecosystem services.
- Decreasing environmentally counterproductive subsidies and extending subsidies to elements relating to resource conservation.
- Tradable permits and obligations / liabilities for ecological damages / compensation pools, land agencies and water pricing.
- Sponsoring / voluntary service markets / marketing of environmentally friendly products / labelling.
- Environmental management / life cycle assessment / corporate social responsibility / environmental and sustainability reporting.
- Information and research on synergies between environmental quality objectives and other social and economic objectives.

Economic instruments alone do not ensure compliance with minimum standards, and hence can normally only be effectively deployed with regulatory instruments. They serve in conflict situations between actors to improve acceptance of regulations, compliance with regulations, and in enabling negotiation and compromise solutions.

2.1.2 Actors Involved in the German Nexus Processes

The aim in practicing of cross-sectoral (meaning regional planning in the context of this study) processes and instruments is that all actors whose concerns are affected by a spatially relevant project should be included at different stages of the procedure, should have equal access to information and can introduce their concerns. At the beginning of the process, the concerns are to be dealt with equally in investigating, evaluating and balancing interests. Translating this to the Nexus topic, all sectors that will be possibly affected at different levels are to be included. A notification or information about the plans is not sufficient in achieving this. A focus of consideration processes is that all concerns brought forward are comparable with each other, which is the basis for the legal assessment of the correctness of the procedure in the judicial review. This means that the concerns are investigated and considered to the same depth, with the same available information.

The setting of the specific Nexus issues and the relevant actors leads to an involvement of different sectoral actors and cross-sectoral stakeholders at different levels of governance (cf. Figure 2).

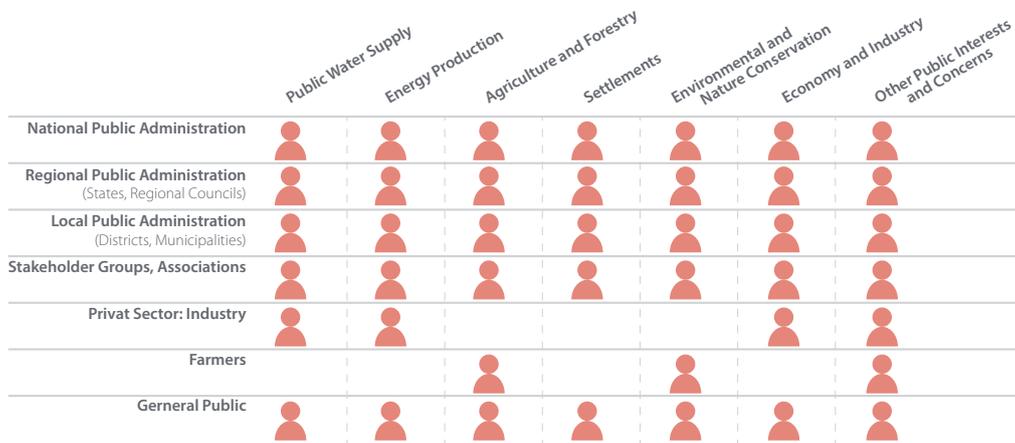


Figure 2: Actors involved in the Nexus perspective in Germany: relevant sectors, concerns and levels, type of actor. Source: own work

Based on the representation of involved actors (Figure 2), the relevant actors to each Nexus situation are to be determined (central actors can be differentiated from other actors) and appropriate coordination platforms are to be developed (see case studies in Chapter 3).

2.2 Approach and Study Methodology

The approach and the methodology of this study are briefly presented in the following subsections. The results of the investigation are found in Chapter 3 and Chapter 4. Figure 3 presents the investigative steps taken.

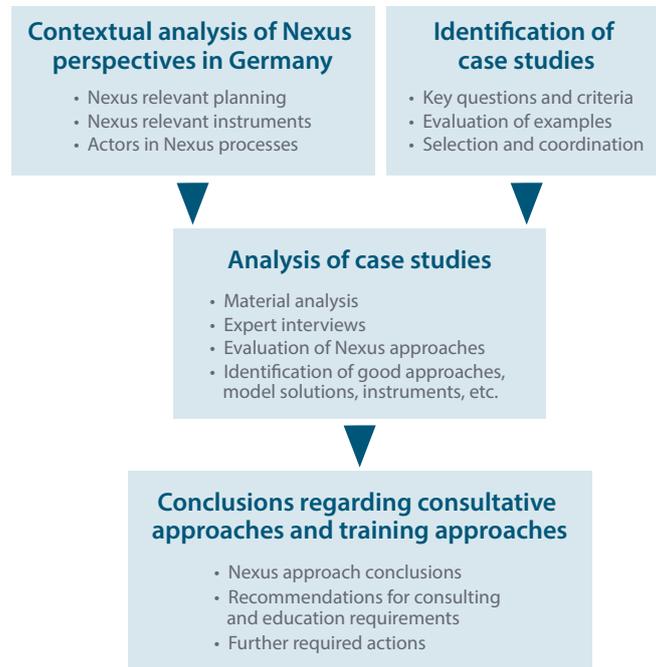


Figure 3: Summary of investigative steps; own work

2.2.1 Approach and Guiding Questions in the Selection of Case Studies

As a first step, instruments and case studies were selected from a literature and document analysis, using an agreed upon approach. These case studies and connected instruments are representative of good planning practice in Germany.

The following guiding questions were set:

- Can a concrete “Nexus perspective” be identified?
- Which instruments, organisational models and planning procedures relevant to Nexus are applied?
- How are sectoral interests incorporated and how are cross-sectoral solutions found (balancing of various interests)?
- What importance do legal, societal and policy frameworks have on weighing interests, finding solutions and optimising planning?
- What are the factors in successful planning and successful projects?
- Which good and transferable examples can be cited?

These questions were debated using a selection of instruments and case studies. These instruments and case studies were chosen to portray a broad thematic spectrum and different (spatial) levels. The following criteria are the basis for the selection of case studies:

- Case studies from the fields of energy, water management or food and agriculture.
- Existing conflicts in objectives or resource utilisation with the other fields of activity.

- Long-standing and proven use of one or more predefined instruments: spatial development plan, regional planning procedure, environmental assessments, organisational models, cooperation forms, economic instruments.
- Involvement of various groups of actors from different areas of activity and spatial levels.

The Rhine River is shown as an example at the level of a large international river basin, as the intergovernmental Nexus cooperation can be organised within the scope of the river basin commission.

The regional interactions between the actors in the spatially limited and intensively used groundwater reserves in Hessian Ried are presented. In this case study, the Nexus primarily comprises utilisation interests of drinking water supply, agriculture and forestry; which need to be reconciled with groundwater resources.

The Nexus connection between water and energy is discussed using the example of pumped-storage plants. A comprehensive investigation and participation process was conducted by means of regional planning procedures, to identify geographically acceptable locations in Thuringia.

Table 1 presents an overview of the case studies and assessment instruments used in this study.

	River basin cooperation (Rhine River)	Water management in Hessian Ried	Pumped-storage plants in Thuringia
Nexus perspective	Water-energy-food and agriculture-biodiversity	Water (supply)-food and agriculture	Water-energy-nature conservation
Nexus-relevant instruments and organisational forms	Institutionalised cooperation: International Commission Contractual solutions Economic instruments Various specialist plans	Cooperation: round table (water management, agriculture, forestry, etc.) Regional planning, approval procedures Specialist planning (water management, agriculture, forestry, etc.) Environmental assessment Economic instruments (extraction fees, funding)	Regional planning procedure Environmental assessments Various specialist plans
Examples of the integration of sectoral interests	Negotiated solutions, institutionalised cooperation	Cooperation, economic instruments, regulatory instruments	Regulatory instruments, discursive instruments
Legal, social and policy frameworks	Downstream and upstream conflicts (international) International pressure on the chemical industry from the agricultural sector Public interest in a clean environment ("Salmon in the Rhine")	Metropolitan areas Drinking water supply shortages Regional agricultural lobby Protection of forests as an environmental good	Energy transition Nature conservation and environmental awareness Public interest in the use of lakes (Agricultural and food issues)
Factors contributing to successful planning and projects	See analysis	See analysis	See analysis
Good and transferable examples (lessons learnt)	See analysis	See analysis	See analysis

Table 1: Characterisation of selected case studies with selection criteria: own research

2.2.2 Context Analysis of the Case Studies

Inspired by the Nexus evaluation methodology from FAO (FAO, 2014), the first step is to conduct a qualitative context analysis. As the study is focussed on the evaluation of processes and instruments in connection with the WEF-Nexus situations, the context analysis is structured as follows:

(1) Determining the Nexus Challenge

Existing conflicts in objectives and resource use within the case study of the WEF-Nexus, as well as from other involved interests outside the WEF prism, (eg. nature conservation) are described. Different from the FAO method, not only the status quo and expected future developments are described, the historical development of Nexus interconnections is also emphasised. As a result, significant developments and paradigm shifts are presented in detail, which are in turn incorporated in the results.

(2) Description of Instruments Applied that are Relevant to Nexus

Applied planning procedures and forms of cooperation are discussed, as are additional instruments, provided they are relevant to the Nexus of the case study. The involved actors and their interests and objectives are also presented in detail. This approach also focusses on the required basis of information and data, as well as essential infrastructure and financial instruments.

2.2.3 Analysis and Evaluation

Building on the described context analysis of each case study, preliminary conclusions are drawn for each case study with regard to the Nexus approach, based on the following questions:

- To what extent do the case study and described instruments follow the Nexus approach?
- What are the success factors and possible failures and shortcomings?

The study deals with the handling and management of WEF-Nexus issues. Therefore, the use of instruments relevant to the Nexus approach are in the foreground of the evaluation. Questions are asked concerning best practice, existing good practice or factors contributing to success for the use of Nexus instruments, and regarding the transferability of practices to development cooperation.

Categories and guiding questions are defined following the classification of solution approaches from the UNECE evaluation method (according to UNECE, 2015; de Strasser et al., 2016):

- **Institutions:** Which stakeholder structure has been proven to function? Are there transferable factors contributing to success?
- **Basis of information and infrastructure:** Which level of information and know-how is needed by the actors? Are particular equipment, data or infrastructure required?
- **Instruments:** Which instruments have proven to be effective?
- **Degree of regulation and financing:** What degree of regulation has proven to be effective? Are economic factors decisive?

Chapter 4 presents the conclusions of the study in the form of hypotheses. Based on these conclusions, recommendations for the use of the findings in the regional Nexus dialogues are developed, and further research requirements are discussed (see Chapter 4.3).

3. PRESENTATION OF CASE STUDIES

Three practical planning case studies were selected for the study, which illustrate the various aspects and tiers of WEF-Nexus issues.

Institutionalised cooperation in the Rhine River Basin (international river basin community) is expected to show how cooperation in transnational river basins has been organised over past decades and can be used flexibly in addressing various WEF-Nexus issues. The involvement of stakeholders in the international river basin commission is a focal point.

The second case study about **Hessian Ried** investigates the connections between groundwater protection, drinking water supply, agriculture and forestry. The example of the groundwater management plan shows how integrated specialist planning can be effectively developed, if the affected parties are involved. Furthermore, various exchange formats (eg. round table) are used, which deal with qualitative and quantitative groundwater issues.

The third case study addresses **pumped-storage plants** in Thuringia. It again illustrates the practical planning approach of the regional planning procedure, in the context of utilisation of water resources by the energy industry.

3.1 Case Study 1: Institutionalised Cooperation in the Rhine River Basin

Nexus Perspective	Water – Energy - Food/Agriculture (- Biodiversity)
Nexus Challenge	International river basin: high water pollution because of intensive exploitation in the upper reaches and the inflow of untreated wastewater. This affects all uses in the lower reaches.
Sectors Involved	Water supply, energy sector, industry, agriculture, settlements, shipping, nature conservation.
Conflicts of Interest	Inflow of sewage and nutrients – drinking water production – land management – flood protection.
Nexus Instruments	Cooperation in an international committee.

Table 3: Characteristics of Case Study 2. Source: own research

3.1.1 The Nexus Challenge

The Nexus challenges primarily exist in:

- The conflicts of use between water supply and agricultural use in the river delta, especially in the issues of irrigation water and soil quality of the floodplains (The Netherlands).
- Diverse industrial and settlement uses in the catchment area, and their discharges into water bodies (Germany, France, Switzerland).
- To a lesser degree, hydropower utilisation in the Middle Upper Rhine (predominantly France).

Further uses such as fisheries, tourism and leisure, and drinking water production from bank filtrates add to the Nexus perspective.

The catchment area of the Rhine River covers approximately 200,000 km². The Rhine River is used more intensively than any other European river (IKSR, 2016):

- Population: almost 60 million people live in numerous settlements and six major urban centres. On average, this equals 290 people per square kilometre, and more than 3000 people per square kilometre live in some urban centres.
- Potable water: the Rhine River provides 30 million people with drinking water. 26,500 water protection areas exist for abstraction of drinking water.
- Economy and industry: six large economic centres are located along the Rhine River. Economic benefits arise from the logistical opportunities offered by the Rhine River, for example as a shipping lane. The advantages due to location are primarily exploited by the companies from heavy industry and the chemical industry, who use water from the Rhine for various industrial production processes and for cooling.
- Agriculture: approximately half of the surface of the Rhine River catchment area is cultivated as agricultural land.
- Shipping and navigation: the 825 km long stretch of river from Basel/ Rheinfelden to Rotterdam is a major shipping lane, with more than 300 million tonnes of goods transported every year.
- Tourism and leisure: There are approximately 900 recreational and bathing waters in the Rhine Basin. There are also some important destinations for both national and international tourism (eg. the Middle Rhine Valley).
- Energy: Many large power stations use water from the Rhine River for cooling purposes. There are also numerous reservoirs and dams, particular in the upper reaches of the water bodies.

These diverse uses compete with each other for the limited resources of water and land (for construction, agriculture, nature conservation, local recreation, etc.). The task at hand consists of bringing the uses and protection of the Rhine River and its tributaries to a compatible balance, where the usage requirements and activities of future generations will not be in question. The impacts of climate change are to be considered in this process (IKSR 2016).

The International Commission for the Protection of the Rhine (ICPR) describes WEF-Nexus issues in the Rhine catchment area as follows:

“During the past 150 years, almost the entire Rhine and its tributaries were dammed or straightened in order to serve navigation, hydropower use, flood protection and land reclamation. Other uses are directly harmful to the Rhine and its floodplain through point source and diffuse inputs of nutrients and pollutants from settlements, industry and agriculture. Over the long term, less degradable substances may accumulate in sediments and organisms. As an example, agriculture adversely affects the groundwater, as high-dose fertilisers and plant protection products can be washed into the groundwater.”

Other pollutions are airborne and derive mainly from emissions from vehicles, power plants and industry, even from regions outside the Rhine River catchment area. Other uses with a partially negative impact include the production of industrial water, thermal pollution caused by using water for cooling purposes, leisure activities and mining activities.” (IKSR 2016)

Development of the Coordination Structure: History and Milestones of the ICPR
(taken from www.iksr.org)

In the second half of the 19th century, the Industrial Revolution led to strong growth in all settlement and industrial orientated uses of the catchment area. The principal areas were the large river valleys, river bank areas, floodplains, and other locations easily accessible by waterways. In these times, environmental qualities such as water quality, ecological structures or riverine landscapes had no societal or political value. Untreated wastewater from many new factories along the Rhine and its inlets was discharged into the river, regardless of the potential damages. The increasing pollution of the Rhine with organic and inorganic waste products created tensions between neighbouring countries, even though it was yet to be analysed and could not be measured. Tensions arose because in and around the lower regions, more specifically in the delta, contaminants in the soils of the flood areas and poor irrigation water quality were evident (colouration, smell, viscosity).

The Dutch people, living downstream, felt their existence threatened by the continually increasing pollution, as they used water from the Rhine as a drinking water supply and for irrigation in agriculture. They also used water from the Rhine to flush out polders, which prevents salinisation of the soil and water in the polders.

The ICPR (more specifically, a forerunner organisation) was established by Germany, France, Luxembourg, The Netherlands and Switzerland on 11 July 1950. Its objectives were to study the contamination of the Rhine, recommend measures for groundwater protection, standardise measurement and analysis methods, and to exchange measurement data. The founding of the ICPR only five years after the end of the Second World is regarded as a political success.

As a first step, a uniform measurement programme from Switzerland to The Netherlands was established.

On 29 April 1963, government envoys from Germany, France, Luxembourg, The Netherlands and Switzerland signed, under international law, the contract “Agreement on the International Commission for the Protection of the Rhine against Pollution” in Bern. Thus, the ICPR obtained an international statute, 13 years after its establishment.

Due to intergovernmental conventions, (chemical convention and chloride convention, both in 1976) emission standards for 12 substances were agreed upon. For the first time in their history, the ICPR announced that the water quality had improved (1977). The oxygen content increased, and the organic load and the phenol (carbolic acid) concentration reduced. Further recommendations of the ICPR to the signatories included a third treatment stage (phosphate elimination) for wastewater treatment plants and cooling towers in power plants, to limit the thermal stresses on the Rhine.

After a fire in a Sandoz-AG warehouse near Basel on November 1, 1986, water used for firefighting which contained up to 30 tonnes of pesticides flowed into the Rhine and killed fish and other organisms for hundreds of kilometres along the river. Protecting the Rhine from Switzerland to The Netherlands was brought into focus for the first time.

Strong public pressure on the governments of the countries in the Rhine River catchment area helped the ICPR grow its influence. In 1987, the ministers approved the ambitious “Rhine Action Programme”, and entrusted the ICPR with its coordination and monitoring of success. Within ten years the quantities of 40 dangerous chemicals introduced into the river ought to have halved. The Rhine should have once again been clean enough that salmon could live in it, which is considered an indicator for the river being in good health. The incident at Sandoz-AG was a turning point for protection of the environment and water bodies in the Rhine River catchment area.

The Rhine Action Programme led to significantly stricter requirements for municipal and industrial wastewater treatment plants, and to the introduction of the third treatment phase for the removal of phosphorous and nitrate. The first results taken in 1992 showed an enormous reduction in pollutants. At the same time, the chemical improvement in water quality is expected to have improved the entire ecosystem, and the overall condition of flora and fauna was strengthened. A good example of a simple and publicly understandable agreement for a common aim on environmental quality, which should be the benchmark for all activities and stakeholders, was the commitment that the Rhine should have salmon living in it by the year 2000. This commitment is understandable for each person, and the goal cannot be easily disputed.

Two catastrophic flooding events occurred on Christmas 1993 and January / February 1995, which drove the European union (EU) environmental ministers tasked the river commissions for the Rhine, Moselle-Saar and Maas to prepare flood action plans. The **Flood Action Plan** was submitted in 1998.

According to the ICPR’s evaluation, a comprehensive and **integrated transnational water management system** was developed between 1897 and 1999, which integrated qualitative and quantitative aspects relating to surface waters and groundwater.

Protection of the environment and of water bodies was first embedded in the objectives of the European Union through the Maastricht Treaty from November 1, 1993. An elaboration to the river basin-related EU policies in the protection of the environment and of water bodies followed, and the ICPR acted as a mentor because of their experiences in international water protection. On 22 December 2000, the European Water Framework Directive came into effect, which continued the principles of integrated water management which had been proven as effective on the Rhine, and its commitments are binding for all EU Member States. The objective of the European Water Framework Directive is to achieve good conditions in all water bodies. Since then, extensive action plans aiming to achieve good ecological conditions have been developed, periodically updated and successfully implemented, in line with this directive. The ICPR are assigned to the role of international coordination and the evaluation of action planning.

As a non-EU country, Switzerland agreed to assist the EU Member States in the river basin coordination, through their role in the ICPR. This was agreed in January 2001, on the basis of their national law.

At the same time, a common working platform (the informal **Rhine Coordinating Committee**) was created in the ICPR, which works towards the coordinated implementation of EU directives in the international Rhine River catchment area. This was achieved with the involvement of Lichtenstein, Austria and Belgium (Wallonia), countries with regions that lie within the Rhine River catchment area, yet are not contract parties to the ICPR. The main purpose of the Rhine Coordinating

Committee is to ensure the required coordination for the implementation of the Water Framework Directive (Richtlinie 2000/60/EG) in the international Rhine River basin. The committee does not make any decisions on its own. The decision-making process is integrated in the ICPR's plenary session, and the committees hold a common meeting.

Internationally coordinated management and flood risk management plans according to EU law were produced in 2015 (see Figure 4).

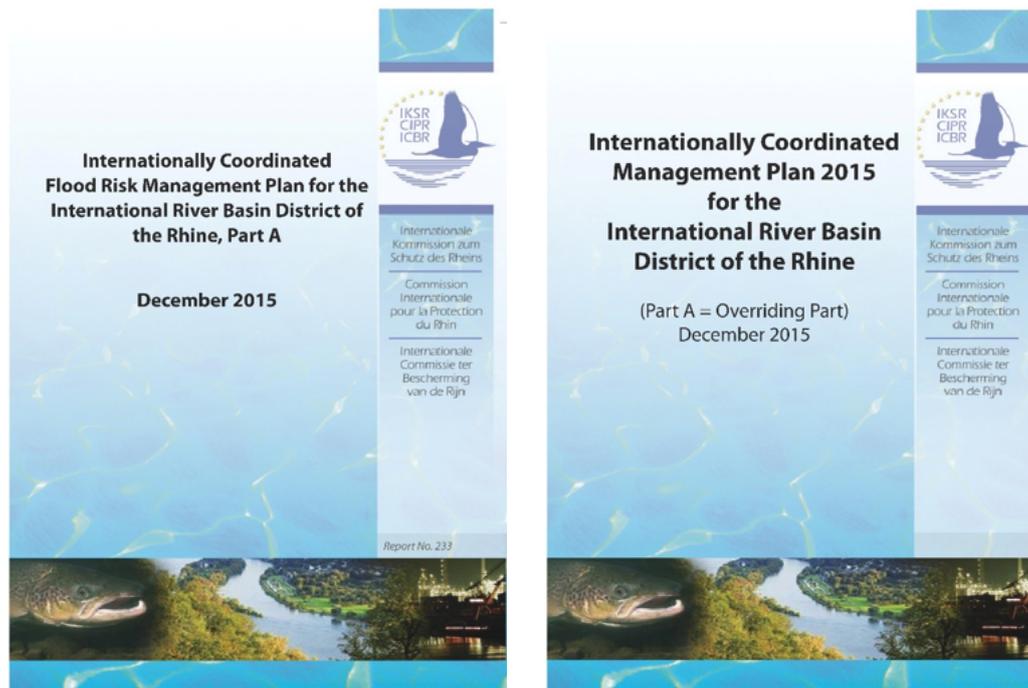


Figure 4: River catchment area plans according to European law

Water quality monitoring is an important task area of the ICPR: it was considered a success that salmon, an indicator for good water quality, were again observed near Iffezheim in the Upper Rhine in 2015 (150 specimens).

3.1.2 Instruments Relevant to Nexus – Cooperation within the Framework of the ICPR

Based on international treaties, the ICPR has developed a stable organisational structure. The Permanent Secretariat, as an independent and neutral office, is staffed with approximately ten workers.¹ It supports the committees described below, with content-related and organisational tasks as well as through translations.

Alongside the plenary sessions, which are normally held annually, the following groups were provided with mandates for 2016-2021:

- Strategy group
- Flood and low-water working group
- Water quality and emissions working group
- Ecology working group

¹ A well-equipped secretariat is essential as an organisational unit; it provides structure and continuity of cooperation" (expert discussion)

The Upper Rhine project group was issued an additional mandate. They support the implementation planning of an efficient fish passageway system at the bar-rages in the Upper Rhine, providing an information and discussion platform with an advisory function.

The working groups are supported by an expert group in geoinformation systems, and by 11 other expert groups.

Generally, the following cooperation principles apply within the framework of the ICPR:

- Political mandate
- Political trust and no sanctions
- National delegations² – active participation in all activities
- Unanimity
- Decisions are recommendations
- Exchange of technical know-how
- Decentralised structure
- Three working languages: German, French and Dutch

Delegates are appointed at the working level by each contracting party. There is a delegation leader at the head of each national delegation. The German delegation in the ICPR consists of representatives of the following ministries:

- Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
- Federal Ministry of Transport, Building and Housing
- Federal Foreign Office
- State representatives from the German states within the Rhine River catchment area (generally environmental ministries)

Non-governmental organisations and other organisations (and also non-participating countries) can apply to be present as observers at ICPR meetings. Numerous organisations are involved in the meetings. As the Rhine River is used intensively as a waterway, there are also permanent and close connections with actors from the shipping and navigation sector. Serving the subject of the ability to navigate the waters, a close exchange exists with private actors in the hydropower sector.

Thus, several sectors (water, nature conservation, transport) are considered in this approach, though the sectors of agriculture and energy / economy, which are central to the Nexus context, are only involved in a peripheral sense. Their involvement can only take place through interdepartmental coordination outside of the meetings. Cooperation with the agricultural sector is often described as insufficient, especially given the sector was a central starting point for the international cooperation.

Stable structures have evolved over the decades, which now serve as model examples for many other river basin commissions. After a lengthy start-up phase, the success obtained by the international cooperation between countries in the Rhine River catchment area, and their legally binding agreements, meant that the ICPR has been able to react to challenges faced throughout the recent decades (cf. Chapter 3.1.1). A shared sense of responsibility has been created on the subjects of water pollution control and diverse sectoral concerns, which all involved parties

² These delegations prepare particular upcoming topics, sometimes (but not compulsorily) through national informal consultations, for example topics in which relevant actors are also involved. Formal stakeholder involvement (and involvement from other groups) takes place explicitly in international cooperation, in the plenary sessions and working groups.

trace back to the good cooperative structures that have grown from patience and diplomacy, over a long period of time.

3.1.3 Nexus Evaluation

The described development of cooperation in the Rhine River catchment area shows that considerable progress in integrated water management could be achieved, when triggered by external factors (pollution, accident, flood, EU directives). Conflicting interests in water utilisation are considered as a whole and subsequently reconciled.

The ICPR is a forerunner for international and intergovernmental cooperation. It provides a binding framework for cooperation in international river basins.

The biggest achievement of the ICPR is doubtlessly that a collective consciousness of the river and its catchment area has been formed. Binding agreements were reached based on this idea of joint responsibility. The ICPR has become an indispensable, renowned and stable institution.

The principle of integration includes the fields of industry, agriculture, shipping and navigation, energy and communities in the scheme of water protection, as all uses have effects on the quality and quantity of water in the Rhine. Assessing the role of the ICPR from a Nexus perspective shows that they are successful in establishing and disseminating an understanding across the entire river basin. The formulation and agreement of more definite objectives in combination with coordinated measurement programmes has ensured that the successes achieved are demonstrable.

Because of the sectors represented by the involved stakeholders, the ICPR is strongly influenced by concerns relating to water management. Other sectors are generally addressed on more of a case-by-case basis. In the Nexus approach, the important agricultural and energy sectors are only involved in to an extent in direct cooperation: **the important agricultural and energy sectors are not (yet) involved as a priority in the cooperative work of the ICPR, they are only involved as secondary matters (eg. as part of cross-departmental coordination) (see Figure 5).**

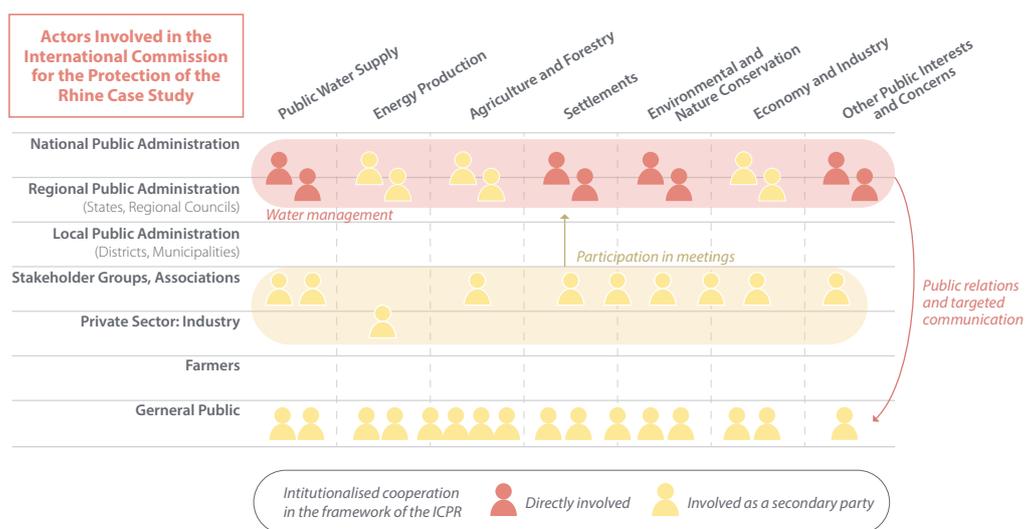


Figure 5: Actors Involved in Case Study: Cooperation in the Framework of the International Commission for the Protection of the Rhine. Source: own research

The transnational and complex nature of the river basin sets a focus on intergovernmental cooperation, which in this case has led to considerable success. Due to the federal structure of Germany, cooperation between the federal states is also required. Individual projects and measures are addressed as long as they have interregional significance. It is therefore essential that regional and local Nexus processes are organised that fall within the scope of the river basin catchment area framework. The EU directives “Water Framework Directive” (2000) and “Flood Risk Management Directive” (2007) are two of the means by which this approach is followed and implemented.

There is a demand that this ideal type of Nexus context approach is followed, though in practice it can admittedly only be partially fulfilled. Sectoral perspectives have gradually converted into a holistic approach over the decades.

Nexus Perspective	Water – Food/Agriculture (- Nature Conservation)
Nexus Challenge	Natural groundwater variability intensified by overuse (eg. drinking water extraction, irrigation for agriculture). The consequences are waterlogging, drying out of soils and damages in buildings, agricultural land and forests.
Sectors Involved	Water suppliers, agricultural, forestry, human settlements, nature conservation.
Conflicts of Interest	Unregulated groundwater abstractions: drinking water extraction – agriculture – forest - nature conservation – human settlements.
Nexus Instruments	Groundwater management plan, balancing of interests and collaboration through voluntary cooperations: round table discussions and cooperation from agricultural and water supply sectors.

Table 3: Characteristics of Case Study 2. Source: own research

3.2 Case Study 2: Groundwater Management in Hessian Ried

3.2.1 The Nexus Challenge

The Hessian Ried, located south of Frankfurt, extends over an area of approximately 1,250 km² and is bounded by Main to the north, the Rhine River to the west, Neckar to the south and Odenwald to the east.

The landscape is a part of the Upper Rhine Plain, and prior to human intervention was a swamp area and part of the natural inundation zone of the Rhine River. The changing of the landscape had already started in the Middle Ages, though widespread drainage and consequent agricultural utilisation first arrived at the beginning of the 19th century. Groundwater fluctuations occur periodically (dry years and wet years) and have effects on agriculture and forests (wetting and drying of soils) as well as on human settlements, or rather the built environment (wet basements, building damages, settlement cracks).

Today, the following user interests dominate:

- Agriculture: Owing to a mild climate and through groundwater extractions and high water availability, high yields are obtained in the Hessian Ried. Special crops, for example asparagus, can be planted. The nitrate contamination in the groundwater is high due to fertilisation.

- Population / Economy / Industry / Infrastructure: The Hessian Ried belongs to the Rhine-Main region, which is one of eleven European metropolitan regions (according to the Ministerial Conference on Regional Planning). It is also growth region, which means that increasing areas for settlements, industry, trade and transport infrastructure will be needed in the future.
- Drinking water use: Groundwater is extracted for drinking water in Hessian Ried.
- Nature conservation / Recovery: Forest areas, swamps and floodplains should evolve as naturally as possible.

Conflicts of Use

Conflicts of use in both dry and wet years have derived from the alteration of natural landscapes to cultivated landscapes, pollution inputs from agriculture, and the intensive exploitation of groundwater resources away from the demand centres, where the extracted supply for these demand centres does not always match the groundwater resource availability. The combination of dry years in the 1970s and 1990s and increased groundwater abstraction led to discernible forest dieback and road damages. Failures also occurred in agricultural irrigation, as shallow suction wells dried up due to sinking of the water table. A joint fund was established by the waterworks and the Hesse State to compensate for the settlement cracks in buildings generated by deep groundwater levels.

Conflicts of use also arose in wet years. Public traffic routes, agricultural areas and a multitude of basements were underwater in the years 1999-2003. The quantity of water from external sources (i.e. not wastewater) in the sewer system was very high. This meant that at times an organised biological cleansing was not possible, as the sewage was too diluted.

Groundwater Management

Since then, various water management measures balance the impacts of high and low groundwater levels. In 1979, to forestall the ramifications of a sinking water table, the Hessian Ried Water Board was founded. Through water infiltration, they ensured sufficient irrigation for agriculture and the raising of the groundwater level in dry years. This process involves extracting water from the Rhine River, purifying it to drinking water quality over a multistage procedure and then percolating it through infiltration systems as well as using it for agricultural irrigation.

Current Use of Groundwater

Groundwater extraction from Hessian Ried provides a significant contribution to the water supply of the Frankfurt Rhine-Main metropolitan region. This region has a combined population of more than 5.5 million, classifying as one of the most dynamic regions of economic strength in Europe. The central area comprises 75 municipalities with approximately 2.2 million inhabitants. The water supply is administered by Hessenwasser GmbH & Co. KG, in which the cities of Frankfurt, Wiesbaden, Darmstadt, the Groß-Gerau district and 14 other cities and communities are shareholders.

The Hessenwasser assets include a total of 21 waterworks and 323 km of transport pipes, from which 63 km have a diameter greater than 2 m. The quantity of useable water supplied is more than 100 million m³/year. (Source: Hessian Ministry of the Environment, Rural Affairs and Consumer Protection, 2005)

3.2.2 Instruments Relevant to Nexus (1) – Groundwater Management Plan as Integrated Specialist Planning

The Hessian Ried Groundwater Management Plan is a management plan according to Section 36 (1) of the Federal Water Act and thereby a tool for expert water management planning. This framework plan is the outcome of a working group operating across different authorities, with the aim to avoid damages caused by low groundwater levels.

The Hessian Ried Groundwater Management Plan was published in 1999, and unique in the country. Through this management plan, the Hessian government has made an instrument available that contains binding standards for water management planning and for all approval processes. Groundwater extractions and infiltration are managed by the water associations, using benchmarks for mean ground water levels and lower water levels. This adherence is controlled by the responsible water authorities.

The Hessian Ried Groundwater Management Plan (1999) attempts to minimise the conflicts between ecology, agricultural pressures, requirements of the groundwater level due to diverse land uses and the impacts of previous groundwater extractions by balancing the interest of different users.

The relevant objectives are:

- The long-term guarantee of local and regional water supply for the population and for economic activities.
- Avoiding building damages from groundwater-related settlement of buildings in inhabited areas.
- Protection of vegetation areas dependent on groundwater levels and rehabilitation of forest and swamp areas already damaged through the sinking of the water table.

Therefore, targeted groundwater levels are defined, and an action plan is developed that most notably also covers the expansion of infiltration systems for groundwater recharge. In conjunction with numerous groundwater measuring points, the groundwater levels are kept within the prescribed limits through a “control”.

First of all, it should be noted that the management plan is a sectoral instrument which attempts to integrate other interests and concerns. However, as a rule, integration remains behind the Nexus approach. This is because, as in this case, plans originate from one sector and then not all parties and interests are equally integrated to begin with. In this case study, water management within the management plan is the dominant component, even though other important concerns were also successfully integrated. Additionally, the management plan must be considered within the framework of voluntary regional cooperation (see the following chapter).

3.2.3 Instruments Relevant to Nexus (2) – Hessian Ried Round Table: Reconciliation of Interests through Voluntary Cooperation

Following a decision by the Hessian State Parliament in 2006, the Hessian Ministry of the Environment initiated and financed a round table for the improvement of the groundwater situation in Hessian Ried. Increasing forest damages acted as catalyst for making this decision. The lowering water table was suspected to have caused these damages, though this point was heavily disputed between the forestry and water sectors. The primary objective of the round table discussion was to achieve a sustainable improvement of forest conditions in Hessian Ried.

It was a carefully planned process and was organised under a **neutral moderation process recognised by the actors**.

Through the initiators (Ministry of the Environment and the regional water supplier), the interests of the actors were initially explored and made transparent, and the composition of the round table was determined (Kummer, 2015):

- Regional government authorities: Ministry of the Environment and Ministry of Economics
- Representatives of different interests: Forestry, water suppliers, environmental associations, nature conservation associations, farmer associations, action groups against waterlogging in houses.
- Districts, cities and municipalities.

The composition was reviewed and revised together with the actors in the initiation phase.

The round table submitted its final report in April 2015. The report contains comprehensive measures and actions for matters in which a consensus could be reached between all involved parties. Compromise was achieved not only between water management and forestry, but also through constructive collaboration from the environmental and nature conservation associations.

The establishment of a forest restoration association was one of the recommendations. The developed measures are not implementable within the scope of the typical administrative actions of the existing authorities. Hence both increased cooperation and funding are needed to further support its implementation.

In this case study, clear conclusions can be drawn on the restricted implementation possibilities due to limited cooperation. On one hand, a time limit has positive implications for some groups who engage themselves primarily in the conceptual phase, as they are not assigned a continuous task which could be blocked due to capacity reasons.

In their time-constrained work, the round table could not conclusively answer the question of financing the implementation of the measures. However, they examined different financing instruments such as non-dedicated state tax revenues, dedicated groundwater extraction charges, other earmarked state fees, and municipal revenue sharing. A final and still outstanding decision on financing is incumbent upon the state government of Hesse, or more specifically, the Hessian Parliament.

3.2.4 Instruments Relevant to Nexus (3) – Cooperation in Water Supply and Agriculture in Groundwater Quality Protection

In Germany, the best practices of agricultural fertilisation are thoroughly regulated in the Fertiliser Ordinance. In water protection areas, the Water Law enables the possibility to make additional rulings that go beyond the existing regulations. In the catchment area for Hessenwasser GmbH & Co. KG, there are 15 water protection areas with a total area of 387 km². In numerous instances the protected area regulations are outdated or lacking in specificity, such that **voluntary cooperation** is often used to confront the increasing nitrate pollution.

For over 20 years a strong cooperation was fostered between water suppliers and the agricultural sector (agricultural cooperation). In the case of Hessenwasser GmbH & Co. KG, this extends to a total of 80 cooperation agreements, which cover approximately 2,300 ha. The cooperation between water management and agri-

culture is based on a voluntary principle. A long term, trusting collaboration with relevant specialists exists. Consultation of the farmers is guaranteed with start-up funding in the framework (3 years up to 60% funding, and a further 3 years up to 20-30% funding). Afterwards, the water supplier must bear all costs alone.

Success of the agricultural cooperation was seen in the form of a declining nitrate concentration in the water. This became apparent after several years due to long residence times of the nitrogen in the soil. Though the significant reduction of nitrogen surpluses resulting from the cooperation could already be demonstrated.

The EU Water Framework Directive established a fundamental paradigm shift. Threshold values are no longer exclusively formulated with regards to the drinking water quality, but rather are based off a comprehensive approach in protecting groundwater assets and interests (good ecological condition). Since 2012, the State of Hesse has implemented and financed guidance measures in Hessian Ried, and these are based on defined areas of action. At the same time, the guidance measures in water protection zones were discontinued. The balance of management restrictions was thus no longer undertaken at the level of individual farmers, but rather regulated by a state-wide agricultural environmental programme. The guidance measures should be integrated in the official agricultural services, which is viewed as critical from the side of the water suppliers.

Financial compensation arising from agricultural disadvantages through management restrictions is, until now, still not sufficiently resolved.

3.2.5 Nexus Evaluation

Three Nexus instruments could be demonstrated in the case study of groundwater management in Hessian Ried. Figure 6 shows the actors involved in the instruments outlined.

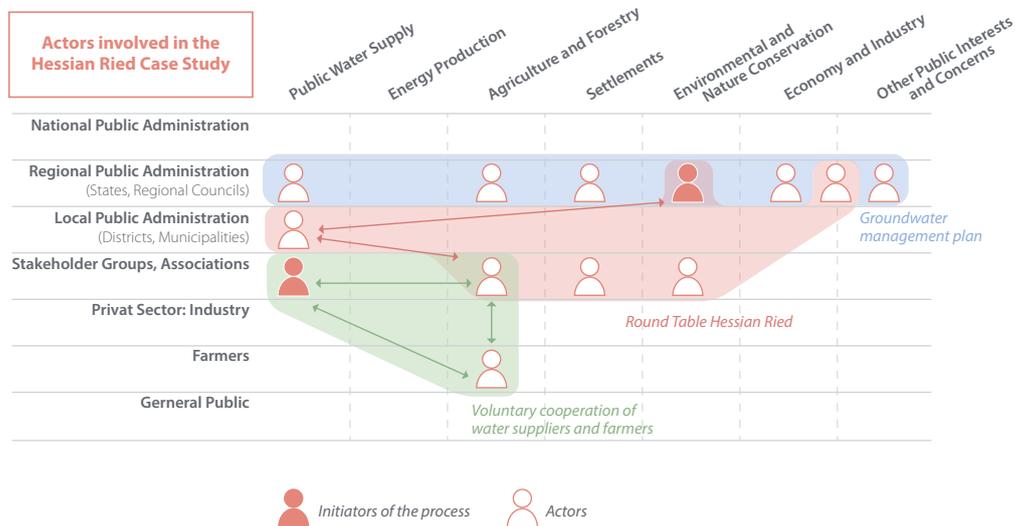


Figure 6: Actors Involved in the Hessian Ried Case Study. Source: own research

The comprehensive management of groundwater resources for various purposes must be based on natural conditions and circumstances, and requires a trust-worthy cooperation between the different user groups: water suppliers, agriculture, forestry, nature conservation and settlements.

Binding groundwater management plans accomplish planning security for all parties involved. They represent an important regulatory instrument that guarantees the minimum requirements for all concerns and interests (prevent deterioration, define achievable minimum requirements). They also establish a foundation for continuing optimisation processes in the framework of other instruments.

The **monitoring of groundwater levels and groundwater quality** enables preservation of evidence and transparency, and most importantly allows the active control of groundwater abstractions and infiltration. This monitoring is the basis for further impact assessments and risk assessments, that are intrinsic to the mapping and development of complex Nexus chains of effect and interactions (cf. Beisheim, 2013; pg. 73). The knowledge of actual results from measures taken, especially the impacts on separate interests that are involved, also forms the basis for negotiations and cooperation as well as improving transparency towards the public.

A carefully arranged round table under recognised and neutral management creates trust and enables viable compromises.

From a Nexus perspective, voluntary cooperations such as the aforementioned round table position the actors to work together. Success occurs when the various actors see a usefulness in working together beyond their own area of responsibility (technical or spatial). Even if the cooperation is initiated by individual actors and follows a certain motivation or target, it is nevertheless emphasised that the involvement of various actors can only be achieved through an equitable design of the arrangement.

Technical fundamentals and expertise are an indispensable basis in addressing all concerns.

A professional compromise can be achieved through an appropriate discussion based on facts. Political decisions are imperative for the implementation of structural and organisational measures and in matters of public financing.

The implementation of policies requires dependable political decisions, notably for the financing and building of sustainable structures.

Voluntary informal cooperation between water suppliers and the agricultural sectors can effectively complement the regulatory law (water protection area regulations, water rights).

From the Nexus perspective, groundwater should be recognised as protected property, independent from its use. Actors involved in water supply generally have a deep interest in a safe groundwater supply. It is therefore clear that in water protection areas, a proactive approach for cooperation with the agricultural sector originates from these water supply actors.

In designing the cooperation, configurations that **are based on specialist knowledge, neutral to special interests and geared to the long-term** are preferred. State financing or state funding therefore appears to be desirable. Financially, economic losses should be taken into account, provided that the losses are caused by restricted agricultural use. Despite this, good agricultural practices that should not negatively impact the groundwater are to be defined and **regularly controlled**.

Nexus Perspective	Water – Energy (- Nature Conservation)
Nexus Challenge	Utilisation of water by the energy sector, site selection
Sectors Involved	Energy sector, nature conservation, water suppliers, general public
Conflicts of Interest	Energy sector - nature conservation, conflicts in site selection, use of drinking water
Nexus Instruments	Regional planning procedure with integrated environmental impact assessment, additional dialogue with involved stakeholders

Table 4: Characteristics of Case Study 3. Source: own research

3.3 Case Study 3: Pumped-storage plants in Thuringia

3.3.1 The Nexus Challenge

Pumped-storage plants (PSPs) have a long tradition in Thuringia. In the 1920s and 1930s in the city of Jena, the industrial company Carl Zeiss AG had the initiative to develop the first PSPs on the Saale River. The construction of PSPs is controversial in the public eye and from a nature conservation perspective, as their construction intrudes into nature and the countryside. This originates primarily from the fact that the storage reservoirs are partially concreted or asphalted to resist the regular stresses caused by varying water levels. As a result, no natural vegetation can develop. Also, a near-natural fluid mechanics system is prevented because of the technical operations of the plant. Furthermore, frequently opposing interests in the utilisation of the water resources exist between the storage of energy and, for example, drinking water production or flood retention practices.

PSPs are a special form of storage power stations, and serve to store electrical energy by the upward pumping of water. Turbines and generators generate electrical currents with the release of this water. The electrical energy is hence generated through the conversion of potential energy of the water, and after the conversion, this electric power is fed into the grid. The efficiency of a pumping cycle amounts to approximately 75-80 percent.

PSPs serve primarily to save a surplus of electrical power in the grid for low-demand times, such as during the nights or on weekends. In times of high electricity demand, the saved energy is dispensed to the power grid to cover the peak load. PSPs are characterised by a high technological development status and technological maturity.

With a total of five existing PSPs, Thuringia is one of the major suppliers of pump storage energy in Germany. The total installed power is 1,525 MW (23% of the installed electrical output in Germany) and the electrical capacity is 12,115 MWh (32% of the electrical capacity in Germany).

The Goldisthal PSP was put into operation on 30 September 2003 after six years of construction, and provides a significant portion of the overall energy generation. A plan approval procedure was carried out in the 1990s. Environmental organisations filed legal action based on landscape and ecological interference, including habitat loss for the endangered wood grouse. An out-of-court settlement was reached, with a negotiated settlement amounting to 3.6 million euros, and the NATURstiftung David Institution was also established. They are an environmental

foundation which operates in the nature conservation sector and in the field of future-orientated energy (natural energy) to “the support of projects in nature conservation and renewable energies in the newly-formed German states”.

The construction costs of the Goldisthal PSP were 620 million euros and the installed generation capacity is 1,060 MW. Regarding the special technical features, the Goldisthal PSP is the first PSP of its performance class in the world that is equipped with asynchronous technology and variable-speed machinery. The interconnections between the upper and lower reservoirs as well as the machine room are situated completely underground, to reduce any adverse effects on the landscape and the ecology from the outset (Ministry for Economy, Labour and Technology, 2011).

The Goldisthal PSP is at present operated by Vattenfall Ltd. According to data, the visitor information centre at the power station was well utilised, approximately 6000 – 7000 visitors per year have participated in tours through the underground facilities. Aside from power generation, the dams of the Saale River cascading spillway assume important tasks such as flood protection and assuring minimum water flows.

Potential Analysis of PSPs and Results

The area of conflict from a Nexus perspective between energy, water managements, agriculture and the environment stems from the increasing focus on the energy transition in Germany. The intermediate storage of energy is a central issue. In 2011, a potential analysis of PSPs in Thuringia was commissioned on behalf of the Free State of Thuringia. The investigation identified locations in Thuringia that were generally suitable for the building of new PSPs, and determined existing dams or reservoirs that were suitable to convert into PSPs.

A total of 10 possible locations for new plants were identified, each with a performance potential of approximately 4.8 GW. Three potential plants at existing dam locations were investigated (Schmalwasser, Weida, Hohenleuben). For two PSPs (PSP Schmalwasser and PSP Leutenberg/Probstzella), regional planning procedures were applied for and carried out under the initiative of project sponsors (see Chapter 3.3.3).

In this case study, an adverse factor for the Nexus approach is reflected in the negative influence that various market conditions have on each other: while agriculture and water supply are subjected to relatively slowly fluctuating boundary conditions (market, society), the energy sector is exposed to very rapid market fluctuations. Hence, the principal interests and the importance of different aspects within the Nexus framework shift quickly. In this example, it is currently unclear if and when the two projects will be pursued by the project developers within the scope of the required (water legislation) planning approval procedures, due to the high dependency that they have on the energy sector market. This also means that all other Nexus interactions are to be reconsidered. For this reason, the round table working on PSP Schmalwasser is currently inactive. In these circumstances, stable processes are hardly possible because the constraints change quickly and unevenly.

3.3.2 Excursus: Regional Planning Procedures (RPPs) with integrated environmental impact assessment

According to Section 15 (1) of the federal government's Spatial Planning Law from 22 December 2008, RPPs are to be carried out to examine the land use impact of regionally significant developments and activities, at a scale beyond the site of the development.

Accordance with the regional planning requirements and the coordination with other regionally significant developments and measures are to be assessed. The regional planning requirements comprise regional planning objectives, regional planning principles and other regional planning needs (§ 3 Spatial Planning Law). All regional planning requirements can be relevant to the Nexus prism. For example, the regional planning objectives and principles are geared to the public service, ensuring healthy living conditions or a healthy environment. A listing of relevant regional planning requirements is only possible for specific areas and affected interests, as it comprises related issues between regional planning acts, spatial development plans, and even further state planning standards. Other regional planning requirements are the objectives of the regional planning, and findings of formal state planning procedures such as RPPs and state planning statements. The procedure is executed by the regional authorities responsible for regional planning.

Section 1 of the Regional Planning Regulation from 13 December 1990 covers regionally significant planning and measures, among other things:

- Construction of an outdoor facility in line with Section 35 of the Building Code requires approval through a procedure involving the public in line with Section 4 of the Federal Emissions Control Act and carried out according to the Environmental Impact Assessment Law, Annex 1, Points 1 to 10 (inter alia, power plants, wind farms, installations for the intensive rearing of animals).
- Construction of a wastewater treatment facility requires authorisation according to Section 60, Paragraph 3, Sentence 1 of the Federal Water Act.
- Construction of, and essential route amendments to piping installations which transport water-polluting substances requires approval according to Section 20 of the Environmental Impact Assessment Law.
- Creation, removal and significant alteration of a water body or its banks requires planning approval according to Section 68 (1) of the Federal Water Act.
- Expansion, new construction and removal of a federal waterway requires determination of the planning and routing according to Section 13 of the Federal Waterway Act.

Taking the Nexus approach, RPPs deal with energy and agricultural systems alongside water management issues, provided that they have a spatially relevant significance. Conversely, neither comprehensive nor detailed forestry and agricultural management are covered. Land use in the form of agriculture, forestry and also settlements is handled in regional planning (state development plans, regional plans, zoning plans).

The typical RPP implementation cases can be classified into the following project groups according to Lautner (1999, pg. 153).

- Traffic – federal highways, state roads, new construction and upgrading of railways, ports, etc.
- Energy supply – power stations, supply services, storage.
- Water management – dams and reservoirs, polders, wastewater treatment plants, pipelines, etc.
- Waste disposal – landfills, incineration plants, recycling facilities.
- Human settlements – hotel complexes, outdoor holiday areas.
- Industry – major industrial and commercial projects, retail areas, natural resource extraction, etc.

Regionally significant plans and projects can have considerable effects on neighbouring states. Affected neighbouring states participate in the RPP according to the principles of reciprocity and equality. If regionally significant plans or projects can have spatial or environmental effects on neighbouring territories, corresponding documentation (land use impact study, environmental impact study) is submitted to the neighbouring territories to officially allow participation. The affected territories then have the possibility to raise suggestions and concerns, or provide guidance. Finally, as with all other outcomes of the participatory process, these must be appropriately and demonstrably incorporated in the decision-making process (planning assessment and determination).

The public can be involved in the implementation of a RPP, perhaps through public display of plans, information sessions and even through position statements.

3.3.3 Instruments Relevant to Nexus – Regional Planning Procedure for Pumped-Storage Plants in Thuringia

With the introduction of (at the time) Section 6a of the Regional Planning Law in 1989, the procedure was nationally implemented. Germany has had comprehensive experience with RPPs since the 1960s, and the RPP instrument has consequently grown over a long time and has been continually optimised by means of numerous experiences. Over the decades, the instrument has proved to be versatile for regional assessments. It is to be emphasised that the procedure is used in an early planning stage and with involvement of the affected sectors, planning is optimised.

In the following sections, two RPPs for planned pumped-storage plants in Thuringia are cited as examples. Environmental impact assessments and public involvement were integrated in both examples of RPPs.

a) PSP Schmalwasser RPP (approx. 1,070 MW)

The project sponsor is Trianel Ltd., and the Thuringian State Administration Office, as the highest-tier regional planning authority, is the process manager.

The following steps illustrate the chronology and scope of the process:

- Execution of the application conference on 12.01.2012.
- Initiation of the RPP, including public involvement and regional environmental impact assessment according to Section 10 Thuringian Regional Planning Law, with a letter dated 30.04.2013 to 78 involved parties.
- Statements from 71 institutions relating to public interest. In the framework of public participation, comments were received from 1133 citizens, 25 associations / action groups and 3 additional municipalities.

The completion of the RPP was marked by the regional planning assessment, which was released on 25.03.2015 with a total of 38 stipulations and 7 notes:

“Regarding the of the overall weighting of interests, it could be generally determined that both the location (upper reservoir, lower reservoir, waterways, caverns, tunnels, factory grounds) and the 380 kV grid connection (transmission line, electric switchboard, underground cables, cable transition facility) of the planned Schmalwasser water storage power plant ... can comply with the stated measures within the regional and state planning requirements.

After examination of the variations provided, the variations IV ... and VI ... show the best land use compatibility.” (TLVwA, 2015)

In the RPP, a so-called procedure for divergence from the objective was integrated, because it was necessary to deviate from the objectives of the official regional plan. In Thuringia, the regional plans from regional planning consortiums are established by representatives of districts and cities, who act as responsible bodies for the regional planning. Regional plans are orientated in a cross-sectional and cross-sectoral manner. They provide a planning basis for spatially significant economic and infrastructure investments, natural resource protection and the public service. The aims of a regional plan are to be followed by authorities and the principles are to be respected. Conversely, the regional plan does not have direct legal implications towards individuals.

As a further characteristic, a round table was set up parallel to the RPP by the project sponsor Trianel Ltd., in connection with on-site regional authorities and action groups. The round table had 30 participants and it was chaired by a mayor from the City of Tambach-Dietharz. In a period of almost 3 years, the round table had a total of 13 sittings (1st sitting on 07.07.2012, 13th sitting on 18.04.2015).

The aim of the round table was to enter into an active dialogue about the future of the project in Tambach-Dietharz, and this was performed on the part of the representatives of affected communities, action groups, associations and authorities within the project sponsor Trianel Ltd.

The recommendations of the round table, or more specifically, those concepts on the topic of water, the energy sector, renaturation, climate, forest conversion and even construction site logistics and traffic were made available to highest-tier regional planning authority. In the case that an issue is of high importance for a particular sector, this sector must be adequately informed. (TLVwA, 2015)

b) PSP Leutenberg/Probstzella RPP (approx. 400 MW)

The project sponsor is WSK PULS Ltd., and the Thuringian State Administration Office, as the highest-tier regional planning authority, is the process manager.

The following steps illustrate the chronology and scope of the process:

- Execution of the application conference on 08.11.2013.
- Initiation of the RPP, including public involvement and regional environmental impact assessment according to Section 10 Thuringian Regional Planning Law, with a letter dated 27.01.2015 to 51 involved parties.
- Statements from 46 institutions related to public interest. In the framework of public participation, individual comments were received from 41 citizens, 3 associations / action groups, 3 companies and 37 people signed a petition.

The completion of the RPP was marked by the regional planning assessment, which was released on 22.08.2016 with a total of 24 stipulations and 2 notes:

“Regarding the of the overall weighting of interests, it could be generally determined that the planned Leutenberg/Probstzella water storage power plant, with all of its components (upper reservoir, lower reservoir, power plant access road, 380 kV grid connection, underground facilities) ... can comply with the stated measures within the regional and state planning requirements.

After examination of the variations provided for the upper reservoir, the Variation Schweinbach shows the best land use compatibility.

Variation A and B of the power plant access road exhibit no relevant difference in regional planning, therefore no preferred option for regional planning was identified.” (TLVwA, 2015)

The preferred option for regional planning will be generally pursued by the project sponsor, with subsequent approval procedures. In this way, the project sponsor utilises the already achieved results from the involvement of other concerned sectors in the RPP. In the approval process, in-depth and often technical preconditions for the granting of an approval are examined and, where necessary, restraints are issued. This is done according to pertinent sectoral legislation.

The advantage of a better integration of Nexus concerns in the RPP goes hand in hand with more expensive and longer planning periods (approx. 2-3 extra years).

3.3.4 Nexus Evaluation

The Nexus consideration shows that private investors from the energy sector are the driving forces behind the investments described above. Through appropriate legislation as well as the design of planning procedures, the public authorities ensure that other sectors are adequately incorporated and that the final solution can have societal consensus as well as being spatially and environmentally compatible. Additionally, the private operators aggressively promote their planning objectives to the public. Figure 7 shows the broad participation of actors involved in the outlined RPPs.

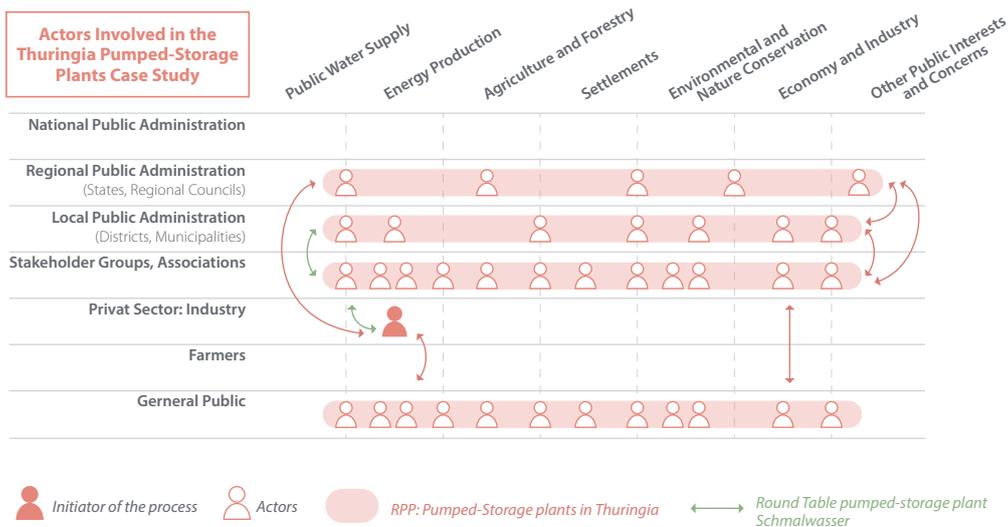


Figure 7: Actors Involved in the Thuringia Pumped-Storage Plants Case Study. Source: own research

Regional planning tools such as **regional plans** and **regional planning procedures** can effectively address issues in the water-energy-food Nexus, when taken into consideration by responsible public bodies (for example: identification and planning of location). The required time for proper RPPs is high and is often criticised in politics, by project sponsors and by the public. The additional related costs are also sometimes considered to be excessive.

However, first and foremost, the procedures bring:

- Greater planning security to the planning authorities.
- Spatially compatible and fair solutions that achieve overall social objectives, brought about by the balancing of differing interests.
- The safety that all actors are involved and the opportunity for participation in the outcomes, or rather an optimisation of the trade-offs and compromises.

There was a drastic lowering of RPP standards (and approval procedures) in the early 1990s. in line with Planning Procedures Acceleration Act, which was orientated towards the further development of East Germany. This law had the key disadvantage of allowing obviously inadequate and not fully integrated planning procedures. The intention of the law was to reduce the timespan from the start of planning to initial operation to a third of the usual time, though this was not fulfilled. Numerous separate and necessary standalone clarifications, contradictions to details which led to late plan modifications and the late legal steps for objections (which could only be reported to one court, though nevertheless were often successful in court proceedings), led to many equally time-intensive and expensive processes being rescheduled and bad investments. All things considered, planning security and early identification of optimisations and compromises is often more effective.

Environmental assessments at all planning levels (strategic environmental assessment, environmental impact assessment) ensure a comprehensive consideration of various environmental issues and concerns, and public involvement. In the case of the Schmalwasser PSP, additional public engagement was provided by the project sponsor to ensure transparency and raise public approval of the project.

4. CONCLUSIONS TRANSFERABLE TO DEVELOPMENT COOPERATION

The evaluated examples showing Nexus approaches in German planning practice have shown that diverse and sometimes long-standing experiences of WEF-Nexus connections exist in Germany (and Europe), only that these connections have been considered using different terms and collected within specific planning instruments. The instruments and processes described have evolved over many years, and have proven their value in the Nexus consideration. The existing good practice and success factors determined for the use of instruments in the Nexus perspective are presented in the following subsections.

4.1 Tried-and-Tested Instruments and Processes Relevant to Nexus

The regional planning procedure has proven to be an effective practical planning instrument in Germany. It provides for:

- Early development of alternative solutions.
- Participation at an early planning stage for public bodies whose concerns are affected and also for other affected parties.
- At the start of the planning process, an introduction and equally valued consideration of various spatial usage requirements.
- Access to planning information (procedural documents) for all involved parties.
- Consideration and balancing of different concerns against each other and with the superordinate objectives of regional planning and development (including the associated environmental standards).
- Evaluation based on socially and politically legitimised aims and principles.
- Results with relatively high planning security for project sponsors as well as transparency for the stakeholders.

The approval planning and approval procedure, which are subsequently required in further planning processes for spatially significant projects, must be based on the results of the regional planning procedure. A stepwise itemisation based on consolidated planning and legally binding interim agreements can be reliably undertaken, by means of the staged planning process. This staged planning and approval approach has proven to be effective in planning practice, leading to resilient interim coordination and agreements.

In addition to the formal and regulatory instruments, **more informal processes**, such as the round table and voluntary cooperation investigated in this study (eg. between water suppliers and the agricultural sector), have penetrated into the planning practice. Though outcomes vary based on alignment and target setting, these informal processes ensure that:

- Transparency is established through comprehensive exchange of information.
- Different stakeholders can voice their opinions equally and in detail.
- New ideas and alternatives are developed.
- A consensus can be found.

In particular, these informal processes function in connection with regulatory instruments by ensuring minimum standards are met, and that unequal balances of power can be equalised. Richerzhagen and Scheumann (2016) present the following points as criteria for success for cooperation between water suppliers and the agricultural sector:

- An existing statutory framework (eg. threshold values).
- An existing sustainable financing model (eg. water abstraction fees).
- Involvement of farmers in the setting of measures.

- The existence of good advisory services and incentives for participating farmers.
- Good availability of data (including pollution sources and nutrient loads).

Informal procedures, particularly at an early planning stage (meaning also in the preliminary stage of a regional planning procedure), significantly contribute to increasing the acceptance of an optimised and (majority) favoured solution. In this way, the round table and other forms of voluntary coordination differentiate themselves from mediation processes, which are implemented in deadlocked conflicts with parties unwilling to budge on their positions.

While informal cooperations should effectively pave the way for regulatory outcomes, further formalised forms of cooperation are necessary to reach contractual solutions outside of regulatory instruments. When negotiated solutions result in transfers between legal partners, an appropriate formalised cooperation framework is required. These can also be developed within national frameworks.

4.2 Findings transferable to the Nexus Approach

The governance of Nexus processes is complex and requires more than one central control instrument in order to find a suitable situation-specific solution in all cases. This applies to both Germany and also to situations in developing countries. The challenge is not only in moderating different water usage interests and power asymmetries, but that in many developing countries, institutional and infrastructural weaknesses exist. Lacking data management or monitoring and control structures are examples of these weaknesses (Dombrowsky et al., 2016).

The following transferable conclusions can be drawn from the evaluations of the case studies presented:

Institutions

- 1) The actors involved and active in the processes should predominantly **reflect the utilisation interests and conflicts**, independent of (administrative) level or field. This can occur through direct involvement (eg. with a round table) or through prior intersectoral coordination (eg. intergovernmental coordination).
- 2) The various stakeholders should be able to voice their opinions **equally** and in detail, or have the possibility to present their stance.
- 3) Where various actors see a **benefit** in working together beyond their own field of responsibility (specialist field or spatial region) voluntary cooperation is successfully established.
- 4) Early **public involvement** in energy and infrastructure projects provides transparency and increases acceptance of the project.

Information Basis

- 5) A technical basis and expertise regarding all involved concerns is fundamental. It is vital to include it very early in the planning stages, and **on equal footing**.
- 6) The intensive use of groundwater resources for various purposes must be **based on the natural factors and conditions**, and requires a reliable cooperation from different user groups: water supply, agriculture, forestry, nature conservation and settlements.

- 7) **Data collection and regular monitoring** (eg. groundwater levels and groundwater quality) **is an important prerequisite**: it serves preservation of evidence and transparency, but also in the active management of the different user interests of a resource.

Instruments

- 8) **International intergovernmental organisational models** have proven to be a binding framework for cooperation and negotiating solutions in international river basins (eg. the objectives of water quality, drinking water production, flood prevention, etc.; the actors in water management, agriculture, economy and industry, energy, shipping, etc.).
- 9) WEF-Nexus issues can be effectively addressed in regional planning instruments such as **regional plans and regional planning procedures** involving the public bodies and their interests (eg. location identification, site planning, restricted areas for groundwater protection).
- 10) **Environmental assessments at all planning levels** (strategic environmental assessment, environmental impact assessment) ensure a comprehensive and cross sectionally orientated consideration of environmental concerns and public involvement.
- 11) Professionally designed **round tables** under neutral leadership (recognised by all parties) create trust and enable viable compromises (eg. compromises in objectives and measures).

Regulation and Financing

- 12) **Binding specialist plans** (eg. groundwater) management plans generate planning security for all involved parties. Implementation of measures generally requires **reliable political decisions regarding financing and the creation of viable structures**.
- 13) **Voluntary and informal cooperation cannot replace regulatory law** (water protection area regulations, water rights), **but it can complement it**.

Furthermore, it is recommended that practical planning experiences from Germany (and Europe) are generally included in the GIZ's advisory and further education capacities (cf. Chapter 4.3).

4.3 Conclusions for Advanced Training Courses

4.3.1 Nexus Regional Dialogues

The European Commission launched the Nexus programme "Regional Nexus Dialogues: Phase 1" in 2015. In January 2016, the Directorate-General for International Cooperation and Development, together with the Federal Ministry for Economic Cooperation and Development, started sponsoring a three-year sectoral project ("International Water Policy"), which is affiliated with the Nexus project "Global Nexus Administration". This project manages existing and new regional Nexus policy dialogues, in cooperation with partner organisations and regional GIZ projects. In addition, the existing online platform will be expanded to become a Nexus knowledge hub.

It is recommended that more European examples for successful practical planning in the WEF-Nexus feed into the regional dialogues. Possible examples and their respective Nexus perspectives are prepared and presented in this study. In particular, the contents of the regional dialogues should include:

- Nexus perspectives from case studies.
- Specific conflict situations and cases of negotiation processes between sectors (eg. the Haringvliet case study with the conflict between agriculture and biodiversity / nature conservation).
- Social, policy and legal frameworks.
- Principles of the planning theory and planning procedure, and their legal planning basis with regard to the requirements of Nexus approaches.
- Interactions between regulatory, economic and discursive (or cooperative) instruments in the case studies.
- Configuration of actors, involvement of actors and stakeholders (processes, constraints, institutional framework, etc.).
- Success criteria and barriers to the Nexus approach from the case studies.
- Financial operating conditions, economic mechanisms and incentives (where appropriate) for participation in relevant Nexus processes.

Case studies can also be made more ‘tangible’ in the training context by having field visits (excursions). Central actors from the case studies, with their range of experience, should be involved in the Nexus regional dialogues.

Special attention should also be given to the roles of spatial planning and cooperative (planning) procedures as essential keys to success.

4.3.2 Further Development Requirements

To use the results of this study in advanced training courses, the following should be developed:

- Curricula for appropriate training units.
- Training modules.
- Training materials (information charts, working material).
- Tailor made excursion programmes (modules)

Further items, which could not be discussed in this short study, should also be analysed. In particular, the handling of practical planning of natural and flood hazards could add another dimension to the WEF-Nexus context, in line with the debate on climate change impacts.

An in-depth analysis of the practice of adapting to climate change in Germany and Europe can also contribute extremely valuable Nexus experiences. As the challenge is relatively new, new structures and cooperation forms are currently being developed, and there are both bottom-up and top-down approaches that could be systematised. The fundamental problem is similar to the Nexus approach: in the cross-sectional task “Adapting to Climate Change”, numerous interactions and user interests must be moderated. As a result, existing instruments, processes and actors from various levels and disciplines are brought together.

Further helpful insights for the further development of the Nexus topic can be provided by the in-depth consideration of the roles played by the following in the Nexus approach:

- Environmental impact assessment / strategic environmental assessment.
- Public participation.

LITERATURE

- Arbeitsgemeinschaft Wasserversorgung Rhein-Main (WRM) (Hrsg.):** Situationsanalyse zur Wasserversorgung in der Rhein-Main-Region, Groß-Gerau Juli 2016
- Beisheim, Marianne (Hrsg) (2013):** Der »Nexus« Wasser-Energie-Nahrung - Wie mit vernetzten Versorgungsrisiken umgehen?, Berlin
- Bund für Umwelt und Naturschutz Deutschland:** 1x1 der Bürgerbeteiligung vor Ort, Berlin 2013
- De Strasser, L., Lipponen, A., Howells, M., Stec, S. and Bréthaut, Ch. (2016):** A Methodology to Assess the Water Energy Food Ecosystems Nexus in Transboundary River Basins. In: Water 2016, 8, 59;
- Dombrowsky, I., Scheumann, W. und Never, B. (2016):** Governance des Nexus Wasser-Energie-Ernährung: Instrumente, Anreize, Mechanismen. Deutsches Institut für Entwicklungspolitik (DIE), Nexus Brief 1/2016
- Ehnes, Albert; Manger, Volker:** Umweltschonende Wasserbeschaffung für die Metropolregion – vom Wassernotstand zur nachhaltigen Trinkwasserversorgung. Sonderbericht in INSIDE OUT, Das Hessenwassermagazin, Hessenwasser GmbH & Co. KG, Frühling 2016
- Food and Agriculture Organization of the United Nations (FAO), (2014):** Walking the Nexus Talk: Assessing the Water-Energy-Food Nexus in the Context of the Sustainable Energy for All Initiative; Juli 2014
- Heiland, Peter (2002):** Vorsorgender Hochwasserschutz durch Raumordnung, interregionale Kooperation und ökonomischen Lastenausgleich; Darmstadt
- Hessisches Ministerium für Umwelt, ländlichen Raum und Verbraucherschutz:** Das Hessische Ried zwischen Vernässung und Trockenheit: eine komplexe wasserwirtschaftliche Problematik, Wiesbaden 2005
- Internationale Kommission zum Schutz des Rheins (IKSR):** The Rhine – A River and its Relations, Koblenz 1998
- Internationale Kommission zum des Rheins (IKSR):** IKSR-Organigramm und –Mandate 2016-2021
- Internationale Kommission zum des Rheins (IKSR):** Geschäfts- und Finanzordnung der IKSR vom 1. Juli 2010
- Internationale Kommission zum Schutz des Rheins (IKSR) (2016):** <http://www.iksr.org/>(letzter Zugriff 20. Februar 2017)
- Kummer, Dr. Bernd et al.:** Runder Tisch – Verbesserung der Grundwassersituation im Hessischen Ried, Abschlussbericht April 2015
- Lautner, Gerd:** Funktionen raumordnerischer Verfahren: ein Beitrag aus Sicht des Verwaltungsrechts und der Verwaltungswissenschaften, Berlin 1999
- Land Hessen:** Ballungsraum Rhein-Main 2015-2045 – Initiative für eine sichere und nachhaltige Wasserversorgung (Strategieinitiative „Wasserversorgung 2015-2045“), Wiesbaden 28. Januar 2016
- Mikat, Dr. Hermann:** Aquiferbewirtschaftung heute und morgen – Einflussfaktoren und Lösungsansätze, Sonderdruck aus bbr Fachmagazin für Brunnen und Leitungsbau, Ausgabe 07-08/2009

Ministerium für Wirtschaft, Arbeit und Technologie des Freistaates Thüringen: Pumpspeicherkataster Thüringen. Ergebnisse einer Potenzialanalyse, Erfurt 2011

Richerzhagen, Carmen; Scheumann, Walentina (2016): Trinkwasserkooperationen mit der Landwirtschaft; Deutsches Institut für Entwicklungspolitik; Nexus Brief 3/2016

Thüringer Landesverwaltungsamt, Obere Landesplanungsbehörde: Raumordnungsverfahren mit integriertem Zielabweichungsverfahren „Wasserspeicherkraftwerk Schmalwasser inkl. Anbindung an das 380-kV-Netz“, Landesplanerische Beurteilung vom 25.03.2015

Thüringer Landesverwaltungsamt, Obere Landesplanungsbehörde: Raumordnungsverfahren „Wasserspeicherkraftwerk Leutenberg/Probstzella“, Landesplanerische Beurteilung vom 22.08.2016

Trianel GmbH: Wasserspeicherkraftwerk Schmalwasser – Unterlage zum Raumordnungsverfahren, Vorhabenbeschreibung und allgemeinverständliche Zusammenfassung, April 2013

United Nations Economic Commission for Europe (UNECE) (2015): Reconciling resource uses in transboundary basins: assessment of the water-food-energy-ecosystems Nexus. United Nations, New York, Geneva, 2015

Weber, Lilo; Mikat, Dr. Hermann: Grundwasseranreicherungsanlagen im Hessischen Ried, bbr 01/2011, S. 1-6

WSK PULS GmbH: Erläuterungsbericht (ROV) zum WSK Leutenberg/Probstzella, 2015

PLANS AND LAWS

Europe

Europäische Wasserrahmenrichtlinie (Richtlinie 2000/60/EG)

Europäische Hochwasserrisikomanagementrichtlinie (Richtlinie 2007/60/EG)

Richtlinie zur Änderung der Richtlinie 2011/92/EU über die Umweltverträglichkeitsprüfung bei bestimmten öffentlichen und privaten Projekten vom 16. April 2014 (Richtlinie 2014/52/EU)

National Level

Raumordnungsgesetz (ROG) vom 22. Dezember 2008 (BGBl. I S. 2986) zuletzt geändert durch Artikel 9 des Gesetzes vom 31.07.2009 (BGBl. I S. 2585)

Raumordnungsverordnung (RoV) vom 13. Dezember 1990 (BGBl. I S. 2766) zuletzt geändert durch Artikel 5 Abs. 35 G. v. 24.02.2012 (BGBl. I S. 212)

Gesetz über die Umweltverträglichkeitsprüfung (UVPG) vom 24. Februar 2010 (BGBl. I S. 94) zuletzt geändert durch Artikel 2 G. v. 30.11.2016 (BGBl. I S. 2749)

Gesetz zur Ordnung des Wasserhaushalts (Wasserhaushaltsgesetz - WHG) vom 31. Juli 2009 (BGBl. I S. 2585) zuletzt geändert durch Artikel 1 G. v. 04.08.2016 (BGBl. I S. 1972)

Netzausbaubeschleunigungsgesetz Übertragungsnetz (NABEG), Artikel 1 G. v. 28.07.2011 (BGBl. I S. 1690 (Nr. 43) zuletzt geändert durch Artikel 7 G. v. 13.10.2016 (BGBl. I S. 2258)

Thuringia

Thüringer Landesplanungsgesetz (ThürLPIG) vom 11.12.2012

Landesentwicklungsprogramm 2025 (LEP 2025), Gesetz- und Verordnungsblatt des Freistaates Thüringen S. 205 vom 04.07.2014

Regionalplan Ostthüringen (RP-O), Thüringer Staatsanzeiger Nr. 25/2012 vom 18.06.2012

Regionalplan Mittelthüringen (RP-M), Thüringer Staatsanzeiger Nr. 31/2011 vom 01.08.2011

Regionalplan Südwestthüringen (RP-S), Thüringer Staatsanzeiger Nr. 31/2012 vom 30.07.2012

Hesse

Hessisches Landesplanungsgesetz (HLPG) vom 12. Dezember 2012 (GVBl. S. 590) geändert durch Artikel 7 des Gesetzes vom 14. Juli 2016 (GVBl. S. 121)

Landesentwicklungsplan Hessen 2000, am 11. März 2013 durch die Landesregierung beschlossen, Zustimmung des Landtages am 27. Juni 2013, in Kraft getreten am 11. Juli 2013 in Kraft getreten (GVBl. Nr. 17, S. 479)

Regionalplan Südhessen / Regionale Flächennutzungsplan 2010, am 17. Dezember 2010 von der Regionalversammlung beschlossen, im Juni 2011 von der Landesregierung genehmigt, in Kraft getreten mit der Bekanntmachung am 17. Oktober 2011 (Staatsanzeiger 42/2011)

Regierungspräsidium Darmstadt (Hrsg.): Grundwasserbewirtschaftungsplan Hessisches Ried, Darmstadt 1999

GLOSSARY

Names of official departments / documents / laws

ENGLISH

Building Code

Environmental Impact
Assessment Law

European Union Water
Framework Directive

Federal Emissions Control Act

Federal Ministry for Economic
Cooperation and Development

Federal Water Act

Federal Waterway Act

Hessian Ministry of the Environ-
ment, Rural Affairs and Consumer
Protection

International Commission for the
Protection of the Rhine (ICPR)

Ministerial Conference on
Regional Planning

Ministry for Economy, Labour and
Technology.

Regional Planning Law

Regional Planning Procedures

GERMAN

Baugesetzbuch

Gesetz über die
Umweltverträglichkeitsprüfung

EU-Wasserrahmenrichtlinie

Bundes-Immissionsschutzgesetz

Bundesministeriums für
wirtschaftliche Zusammenarbeit
und Entwicklung

Wasserhaushaltsgesetz

Bundeswasserstraßengesetzes

Hessisches Ministerium für
Umwelt, ländlichen Raum und
Verbraucherschutz

Internationale Kommission zum
Schutz des Rheins (IKSR)

Ministerialkonferenz für
Raumordnung

Ministerium für Wirtschaft,
Arbeit und Technologie

Raumordnungsgesetz

Raumordnungsverfahren
