Measuring effectiveness of practices for knowledge co-production around hydrological modelling: need for a framework?

Anne Gädeke[1], Kashif Shaad[2], Ina Pohle[3], Mark Wilkinson[3], Hagen Koch[4], Sudhir Chella Rajan[1,5]

1) IGCS INDO-GERMAN Centre for SUSTAINABILITY
2) CONSERVATION INTERNATIONAL
3) The James Hutton Institute
4) PIK
5) INDIAN INSTITUTE OF TECHNOLOGY MADRAS

Background

Interaction with stakeholders has become increasingly important over the last decades due to the ever-increasing challenges water managers face

→ Increasing water pressures

→ Implementation of more Integrated Water Resources Management (IWRM)

→ Coping with climate and land use change

→ Developing adaptation strategies to climate and land use change

Background – hydrological models

Hydrological models are increasingly used to support decision-making in the management of natural resources. Models can provide

→ System understanding

→ Projection of system behavior

→ Learning platform for stakeholder engagement

→ Testing tool of alternative management strategies (Fulton et al., 2015)

Background – hydrological models and stakeholders

Acceptance of modeling results is often highly contextual, depending on

→ the type of problem addressed

→ the social, political and economic implication of the message

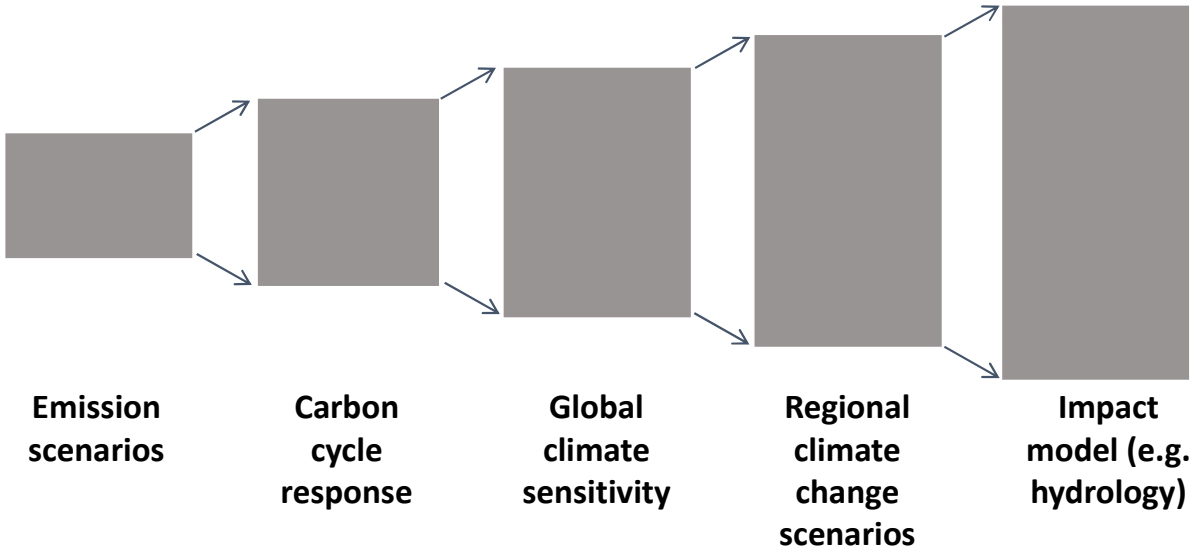
→ the type of audience

→ the charisma and reputation of the messenger

While this is well known to social scientists, modelers are often ill-prepared to address this problem.

For a modeler, acceptance of model results is usually discussed in terms of data accuracy, model reliability and problem uncertainty, not in terms of messenger or the audience (Fulton et al., 2015)

Climate change impact assessments - even more complicated….



Modified after IPCC 2001

Motivation

Long-term feasibility of any proposed climate change adaptation strategy hinges on appropriate stakeholder engagement.

How to engage stakeholders climate change impact assessments? How to ensure that stakeholder accept, trust etc. modeling results?

Overall (long term) goal:

Development of a framework that contributes towards establishing Best Management Practices for knowledge co-production in a participatory approach (using model results).

Different types of stakeholder engagement

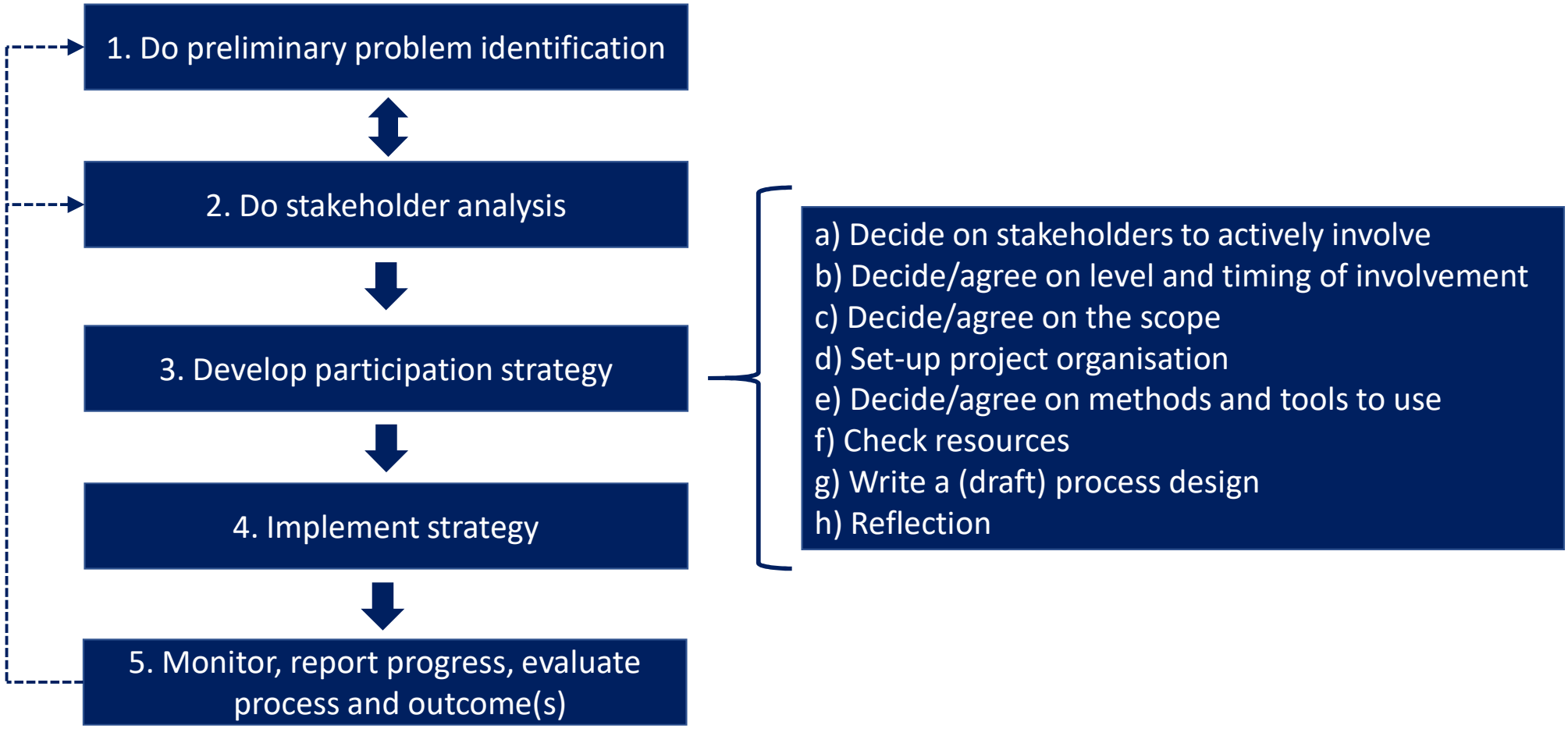
1) Consultation
2) Informing
3) **Participation**

→ Direct contribution and involvement in the project (preferably already during planning phase)

→ Learning by all stakeholders (including the researcher!)

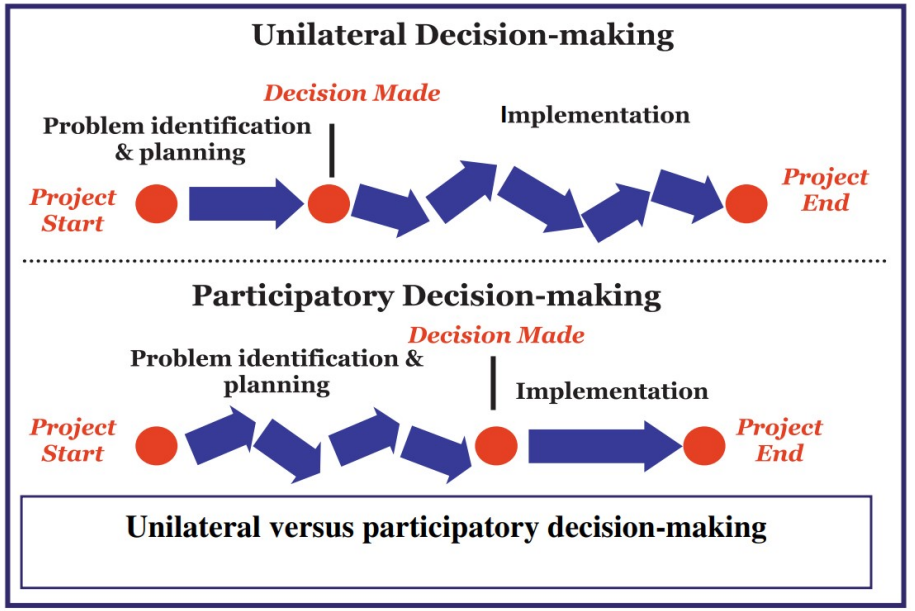
→ Management needs to take place together, since no one has all the necessary legal, financial and other resources to tackle to task satisfactorily on their own

Overview (of ideal) participation process



Challenges related to participatory approaches

- Power
- Costs/Resource intensive
- Time
- Outcomes are open/uncertain (outcomes cannot be predetermined)
- Requires sharing of responsibilities
- Cannot be imposed



Case studies

- Lusatian river basins located in Central Europe
- Rio Sao Francisco located in North-Eastern Brazil

} Application of SWIM Model

- Case studies from Dongjiang River (tributary of the Pearl River system) in southern China, from UK and India

- **Still looking for additional collaborations!!**

Framework of case study

INKA BB – Innovation Network Climate Change Adaptation Brandenburg Berlin

Development of climate change adaptation strategies in the region Brandenburg/Berlin (project duration: 2009-2014)

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Federal Ministry of Education and Research

KLIMZUG climate change in regions

Subproject 21:

- Improvement and coupling of modelling tools for an integrative management of water quantity and quality
- Proposal and evaluation of suitable climate change adaptation strategies

Project team:

Brandenburg University of Technology Cottbus - Senftenberg

P I K Potsdam Institute for Climate Impact Research

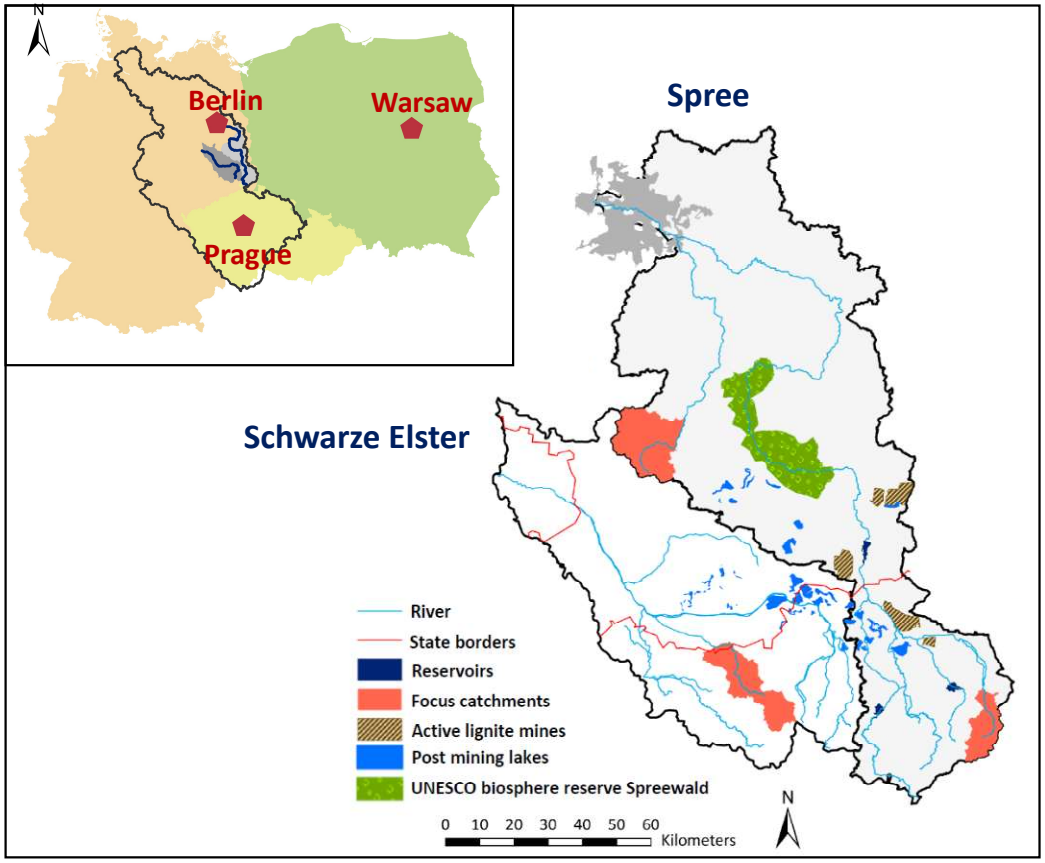
Dr. Uhlmann IWB

DHI WASY

LMBV Lausitzer und Mitteldeutsche Bergbau-Verwaltungsgesellschaft mbH

Case studies

Lusatian river watersheds in North-eastern Germany

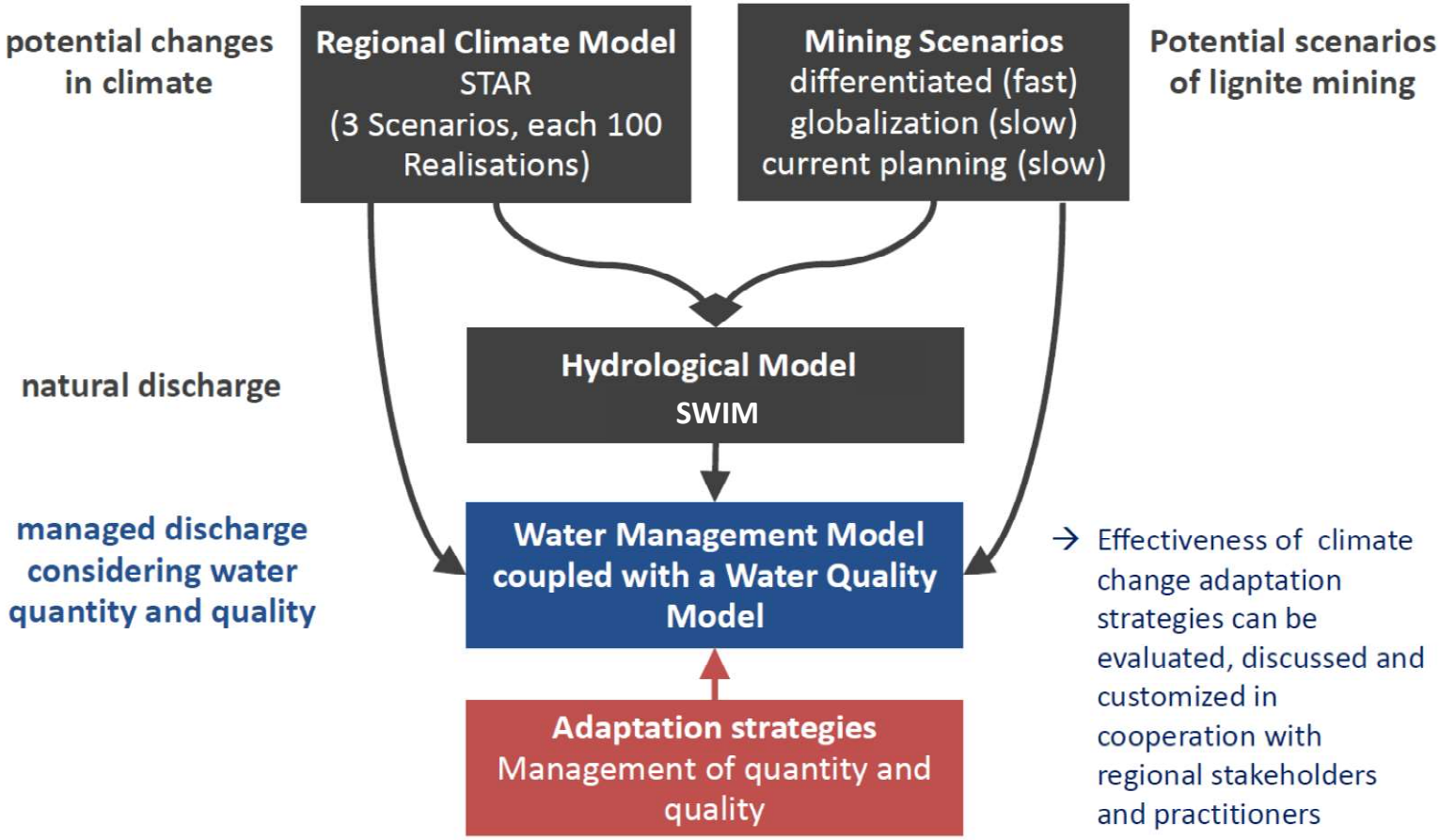


	Lusatian Rivers
Area [km^2]	16,000
Population [million]	~6
Water users	Mining (power plants), industrial, domestic, fishery
Climate	Humid continental
Natural water availability	Low
Biggest anthropogenic impact	Mining
Concern	Water quantity and quality, user conflicts

Approach for stakeholder involvement

Method	SWOT Analysis
Mode of interaction	Workshops (2), written surveys (2)
Number of participants	18 (at kick-off workshop), 4-5 written survey
Type of stakeholders	Governmental agencies, private, NGO and academic sector

Modeling methodology for climate change impact assessment



Methodological approach

A **SWOT** analysis is a structured planning method used to evaluate the

- **S**trengths
- **W**eaknesses
- **O**pportunities
- **T**hreats

involved in a project

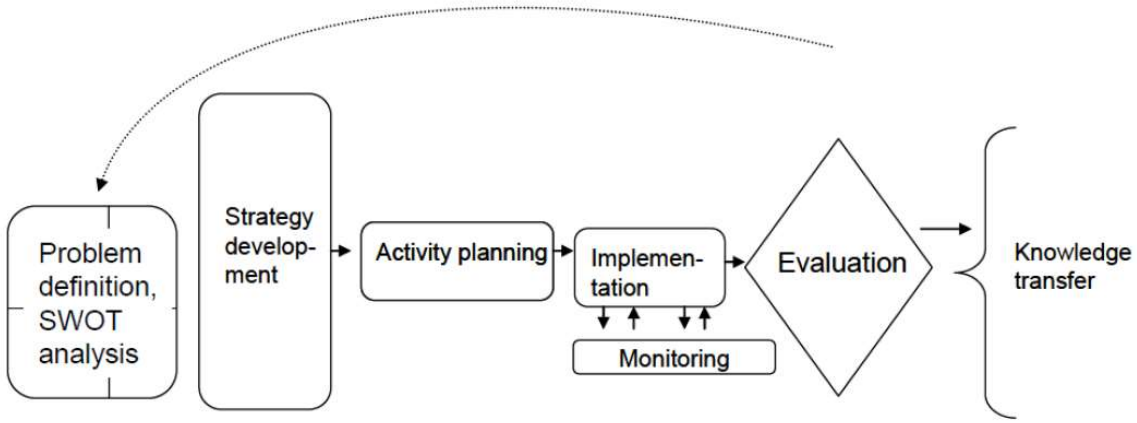
A SWOT analysis involves

- specifying the objective of the project
- identifying the internal and external factors that are favorable and unfavorable to achieve that objective

Methodological approach

3 SWOT Analysis during different project phases

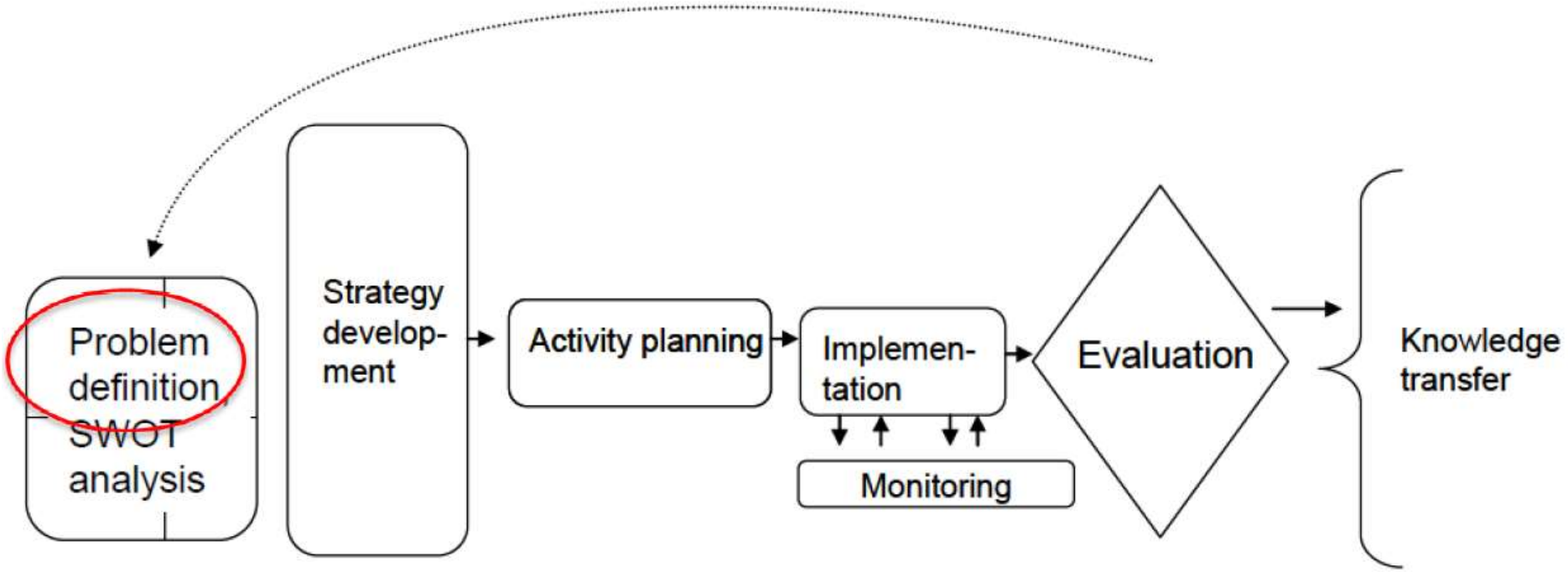
- 1st year: A comprehensive situation analysis as a prerequisite for laying a foundation for a transparent, collaborative definition of the project objectives
- 3rd year: After the first implementation and evaluation phase
- 4th year: After the second implementation and evaluation phase



→ Give as little work as possible to regional stakeholders and practitioners

1st SWOT workshop

Form of realisation: workshop



1st SWOT workshop

Form of realisation: workshop

Participants: 18 from 11 institutions (regional authorities and private companies)

Strength: cooperation between stakeholders, **practical orientation of the project, long term engagement of project leaders in the region**

Weaknesses: conflicts of interest, **lack of coupling** of surface- and groundwater, quality and quantitiy

Opportunities: cooperation with regional planning, **improve long term planning basis**

Threats: **uncertainties** in climate projections, **planning errors** due to uncertainties in climate projections

2nd SWOT workshop

Form of realisation: written survey

- Project results of the first 2 years were summarized in a working paper and send to 9 different institutions (potential impact of climate change on natural discharge using modelling ensemble)
- 5 stakeholders participated

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Form of realisation: written survey

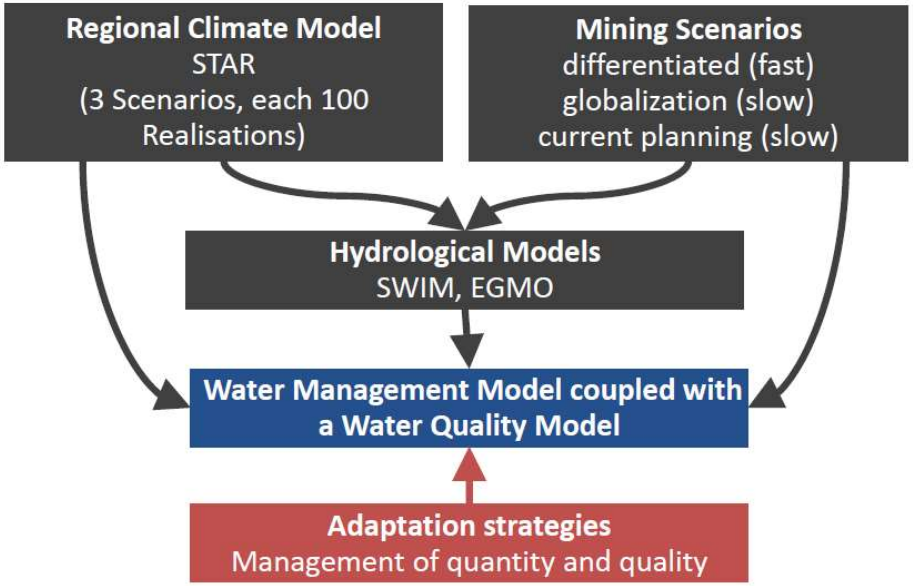
- Project results of the first 2 years were summarized in a working paper and send to 9 different institutions (potential impact of climate change on natural discharge using modelling ensemble)
- 5 stakeholders participated

Strength:	Good databases, relevance of the results for regional planning, **methodological approach**
Weaknesses:	**Large variability** of modelling results due to ensemble approach
Opportunities:	**Increasing relevance of water in regional planning**
Threats:	Climate change impacts are superimposed by **other problems**, developed tools require advanced knowledge

3rd SWOT workshop

Form of realisation: written survey after a regional conference

- Participants were informed before the conference about the details of the SWOT analysis
- Content: potential impact of climate change on natural and managed discharge, improvement of modelling tools and coupling of models for water quantity and quality



3rd SWOT workshop

Form of realisation: written survey after a regional conference

- Participants were informed before the conference about the details of the SWOT analysis
- Content: potential impact of climate change on natural and managed discharge, improvement of modelling tools and coupling of models for water quantity and quality
- Survey was sent to 8 institutions
- 4 stakeholders participated

Strength:	Methodological approach, advancement of **integrated analysis of water quantity and quality**, modelling tools developed can also be used for other management purposes, close cooperation with stakeholders
Weaknesses:	**Large variability** of modelling results due to ensemble approach
Opportunities:	**Awareness** for the necessity of adaptation to climate change was risen, fast reaction is now possible
Threats:	Increasing number of extreme events, planning errors due to **uncertainties**

Lessons learnt

- Include stakeholders in the design of the project
- Include sufficient (financial) resources for workshops/official trips
- Use simple language, avoid too many abbreviations and technical terms
- Define scenarios together with stakeholders (define worst case, moderate and best case scenario)
- Focus on main output which is relevant for them
- Current weather conditions (including uncontrollable and random events, e.g. strong droughts or extreme floods), can have a big effect on the interest/ acceptability of climate change impact studies
- Large variability of results (due to model ensemble approach) may lead to passivity to plan/initiate planning for adaptation measures
- Planning for adaptation measures requires long term commitment

Lessons learnt

- Keep stakeholders interested is difficult especially when weather conditions are “not in line” with current climate scenarios
- Mode of interaction frequency is critical (participants may get fatigue)
- Good moderator/facilitator necessary
- Other water management issues may be more pressing than climate change
- Problems related to water management, decision making processes dependent on specific conditions in country/watershed
- Pressures often considerably higher in developing countries
- Decision making in transboundary watersheds more complicated
- Funding agencies need to acknowledge the added-value and the additional efforts necessary for knowledge co-production