

epa1121 Lecture 4

# Developing the problem statement and storyline

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# Aims of today's lecture

- Demonstrate how to proceed from analyzing a problem context to writing an issue paper
  - Recap of the purpose of an issue paper
  - Walk-through of analytical methods
  - Focus on:
    - identifying relevant knowledge gaps
    - developing a convincing “story line”
    - designing a research plan
- Highlight most common types of policy-relevant research questions and appropriate methods
  - Relations between factors
  - Dynamic system behavior
  - Preferences of stakeholders
  - Costs and benefits of policy options

# Why write an issue paper?

Explain the dimensions of the problem and the possible scope of solutions to enable the client to decide either

- to do nothing further, or
- to commission a definitive study looking toward some sort of action recommendation

(E.S. Quade, *Analysis for public decisions*, Elsevier North-Holland, 1989, p. 72)

# When is an issue paper *good*?

When after reading it, the client

1. recognizes the relevance and value of the analysis for his/her problem situation
2. agrees that a reasonable decision on how to address his/her problem can only be made after remaining knowledge gaps have been addressed
3. is convinced that the research plan at the end of the issue paper will produce the knowledge necessary to support a sound decision.

# Structure of an issue paper

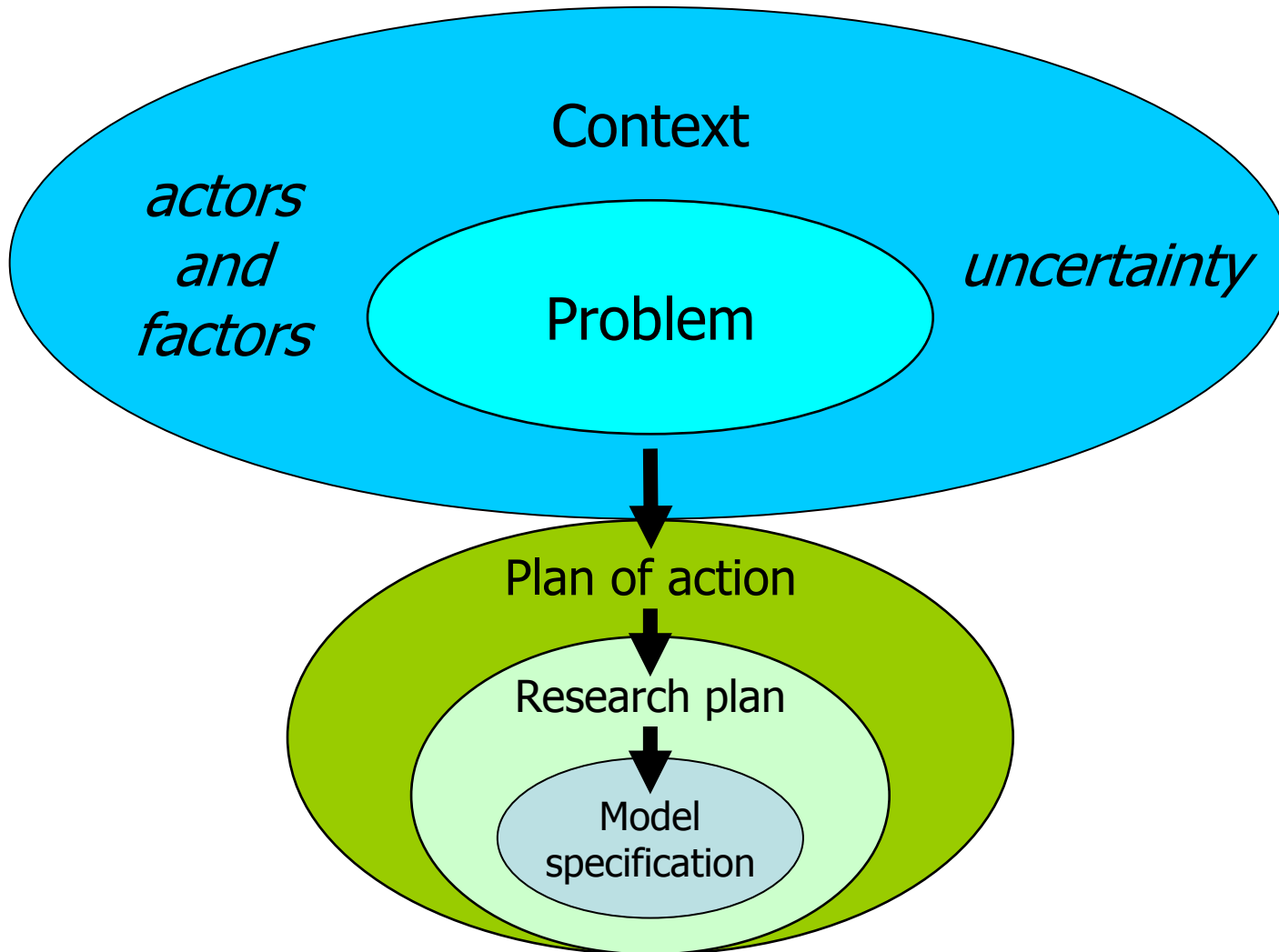
1. Introduction
2. Problem analysis
3. Plan of action + research plan
4. Appendices

***Checklist for a good issue paper:  
Reader pages 163-165***

# Part 1: Introduction

- 1. Problem:* gap between desirable situation and actual or expected situation  
(Indicate geographical scope and the time horizon!)
- 2. Problem owner:* actor to be supported in making a decision
- 3. Alternatives:* different possible solutions, and possible benefits and drawbacks of these solutions
- 4. Complexity:* technical, societal, managerial and political reasons why this problem is hard to solve  
(Indicate interdependencies and conflicting interests between different actors involved)
- 5. Dilemma:* choice or decision the problem owner needs to make, for which (s)he is currently ill-equipped

# “Leading thread”



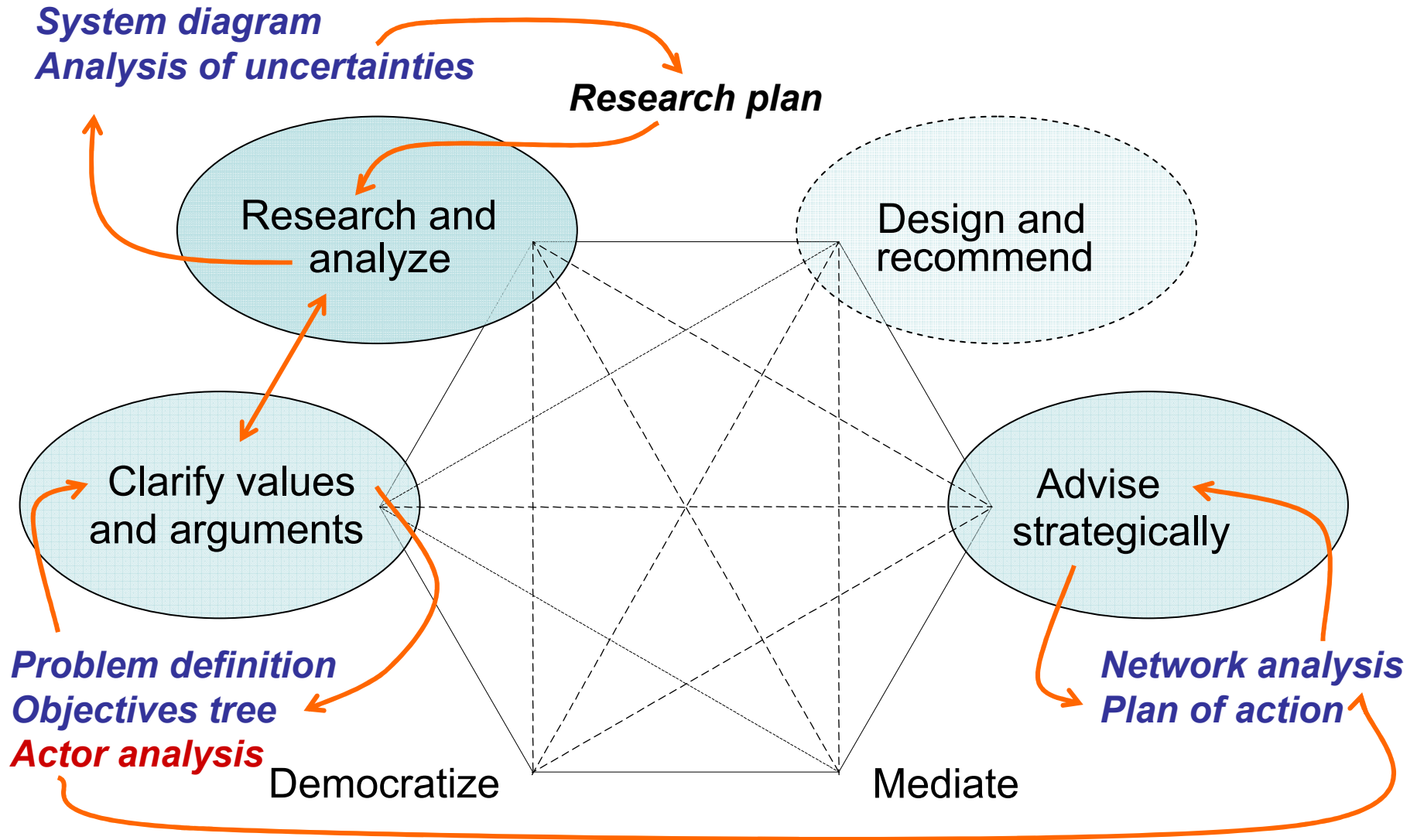
# Analytic methods

- System analysis
  - Means-ends diagram
  - Objectives tree
  - Causal relations diagram
  - System diagram
- Actor network analysis
  - Formal chart
  - Actor perceptions (problem formulations table)
  - Resource dependency (critical actor table)



# Policy analysis activities

The hexagon model (Mayer, Van Daalen & Bots, 2004)



# Illustrative case: Bisphenol A

- Bisphenol A (BPA) is used as a plasticizer for polycarbonate plastics and epoxy resins used in many consumer products (toys, bottles, coating of beverage cans, water pipes, ...)
- Dissolves well in water, degrades only very slowly, and is not removed by conventional waste water treatment techniques
- Even low concentrations may pose a health risk for both animals and humans

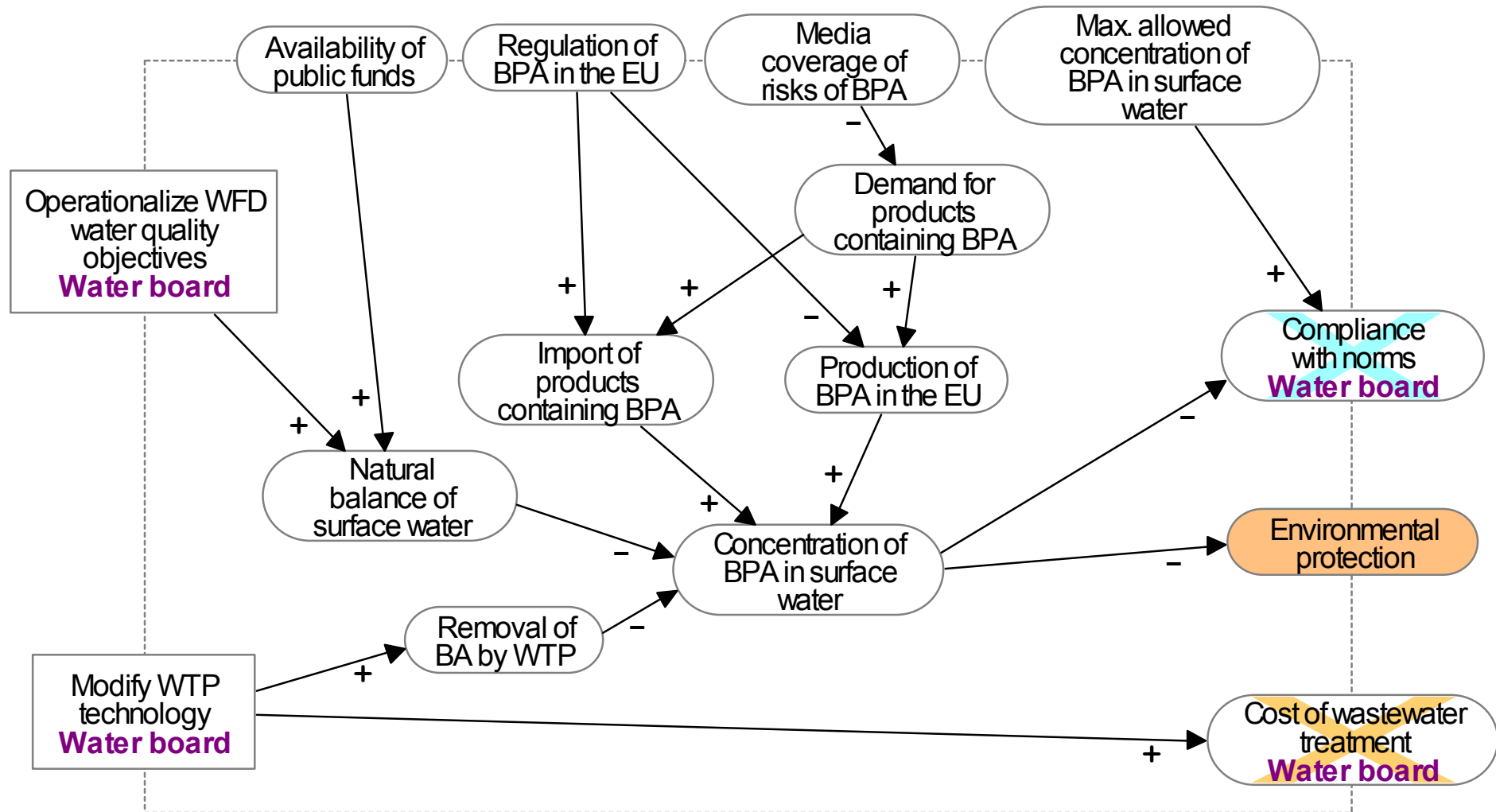
## ***Literature:***

L. Vandenberg, R. Hauser, M. Marcus, N. Olead and W. Welshons (2007)  
Human exposure to bisphenol A. *Reproductive Toxicology* 24(2), 139-177

# Problem formulation

- **Client:** Water board (Dutch local water authority)
- **Gap:** Concentration of BPA in surface water may exceed norm value
- **Cause:** BPA leaches out of plastic end products and ends up in surface water because waste water treatment plants do not filter out BPA
- **Dilemma:** Reduce BPA concentration in waste water without incurring high cost

# Initial system diagram for the water board



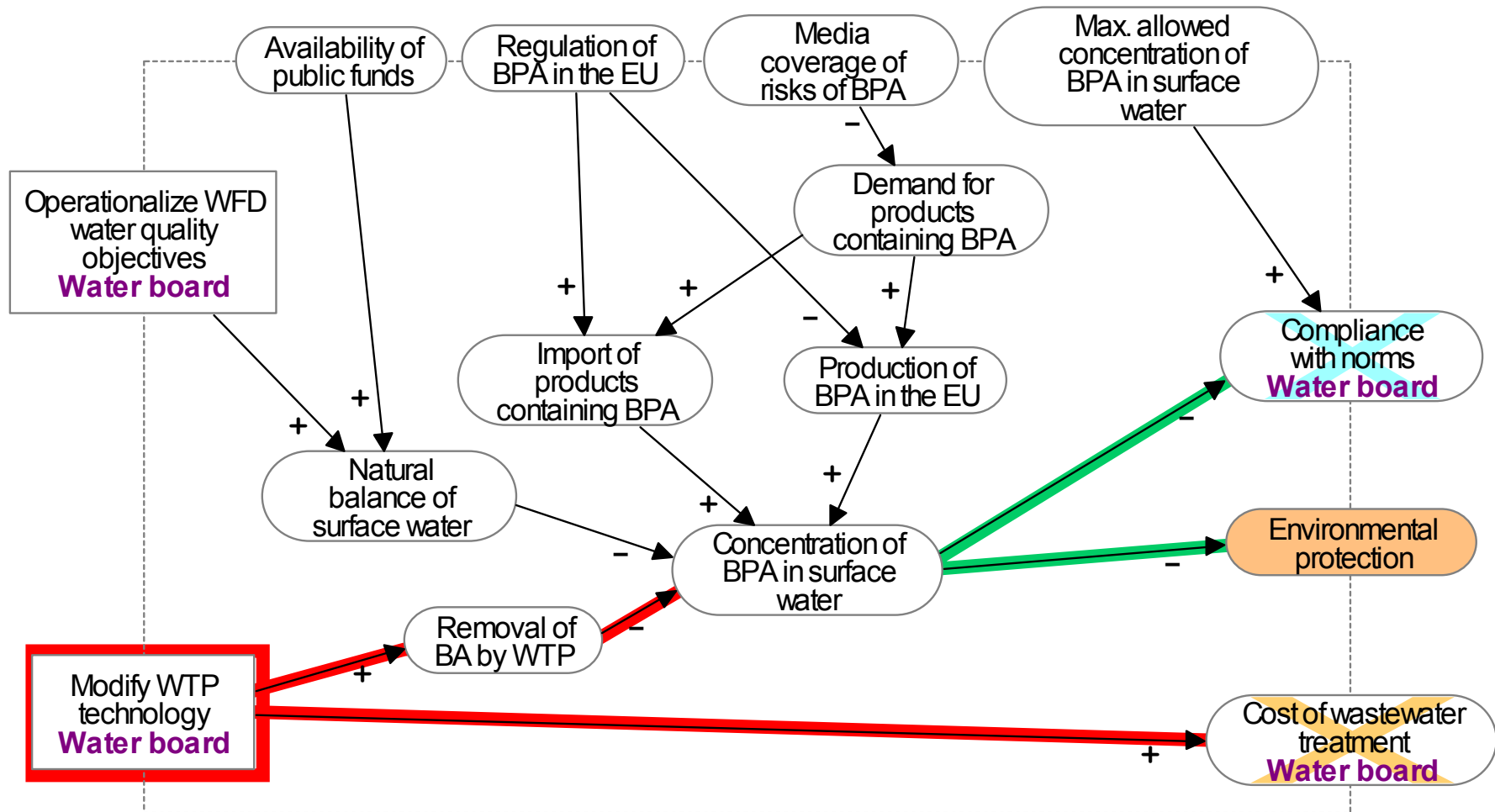
## Legend to goals:

Factor should ...  increase  decrease X NOT increase X NOT decrease

# Useful uses of a system diagram

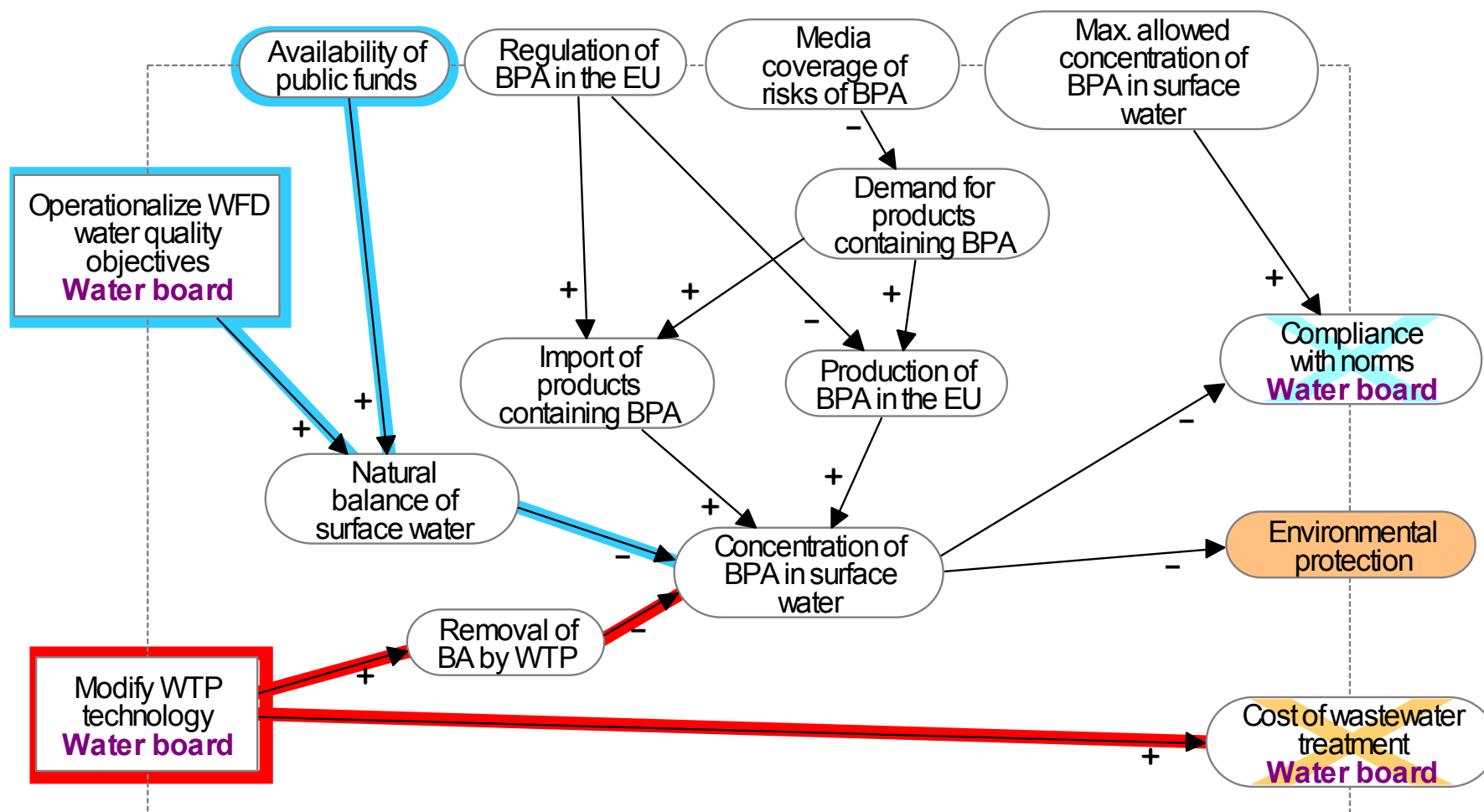
1. Look for intrinsic dilemmas
  - Actions or changes that are good for some goals but bad for other goals
2. See whether actions are effective
  - Can the client attain all of his goals?
3. See whether criteria are sensitive to external influences
  - How much control has the client over his criteria?
  - Might the client's goals be attained without taking action?
4. See whether other actors may help to attain goals
  - Identify actions and actors capable of influencing key factors
5. See whether other actors are stakeholder
  - Identify factors in which other actors take an interest

# 1. Look for intrinsic dilemmas



- █ Fortunate: decrease in concentration helps to attain two goals
- █ Dilemma: action is good for two goals, but bad for a third goal

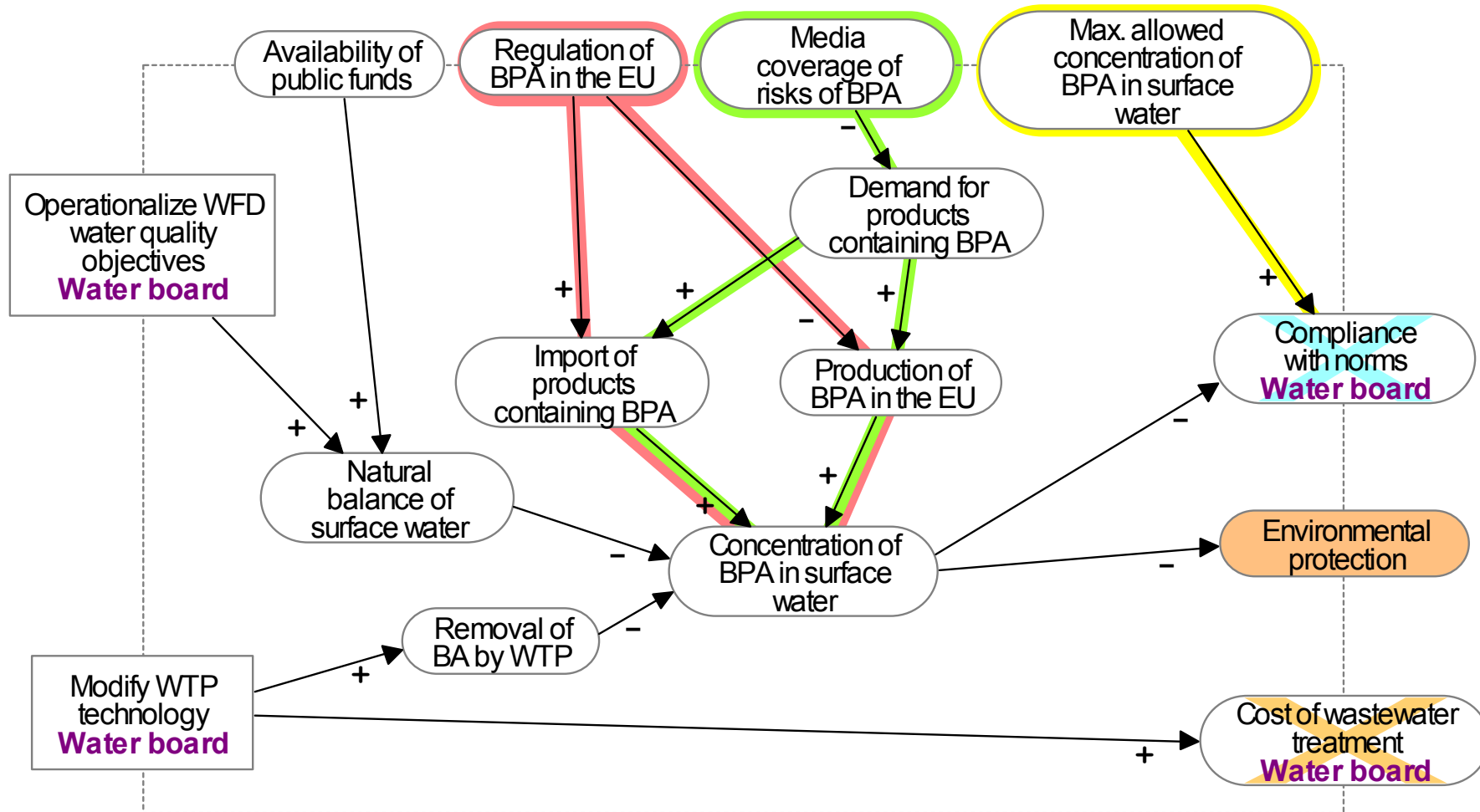
## 2. See whether actions are effective



■ Uncertain: effectiveness of action depends on an external factor

■ Dilemma: action is good for two goals, but bad for a third goal

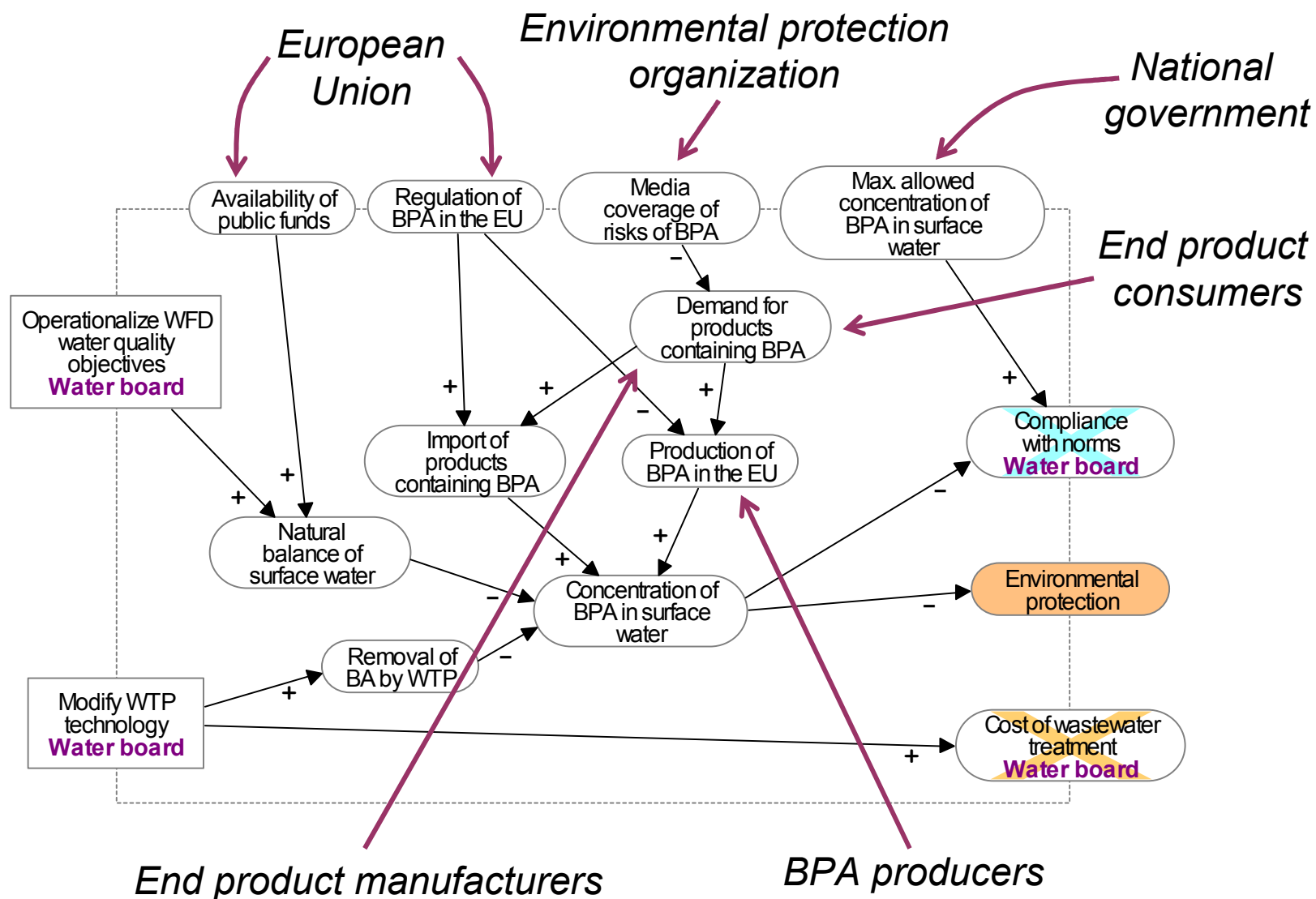
### 3. See whether criteria are sensitive to external influences



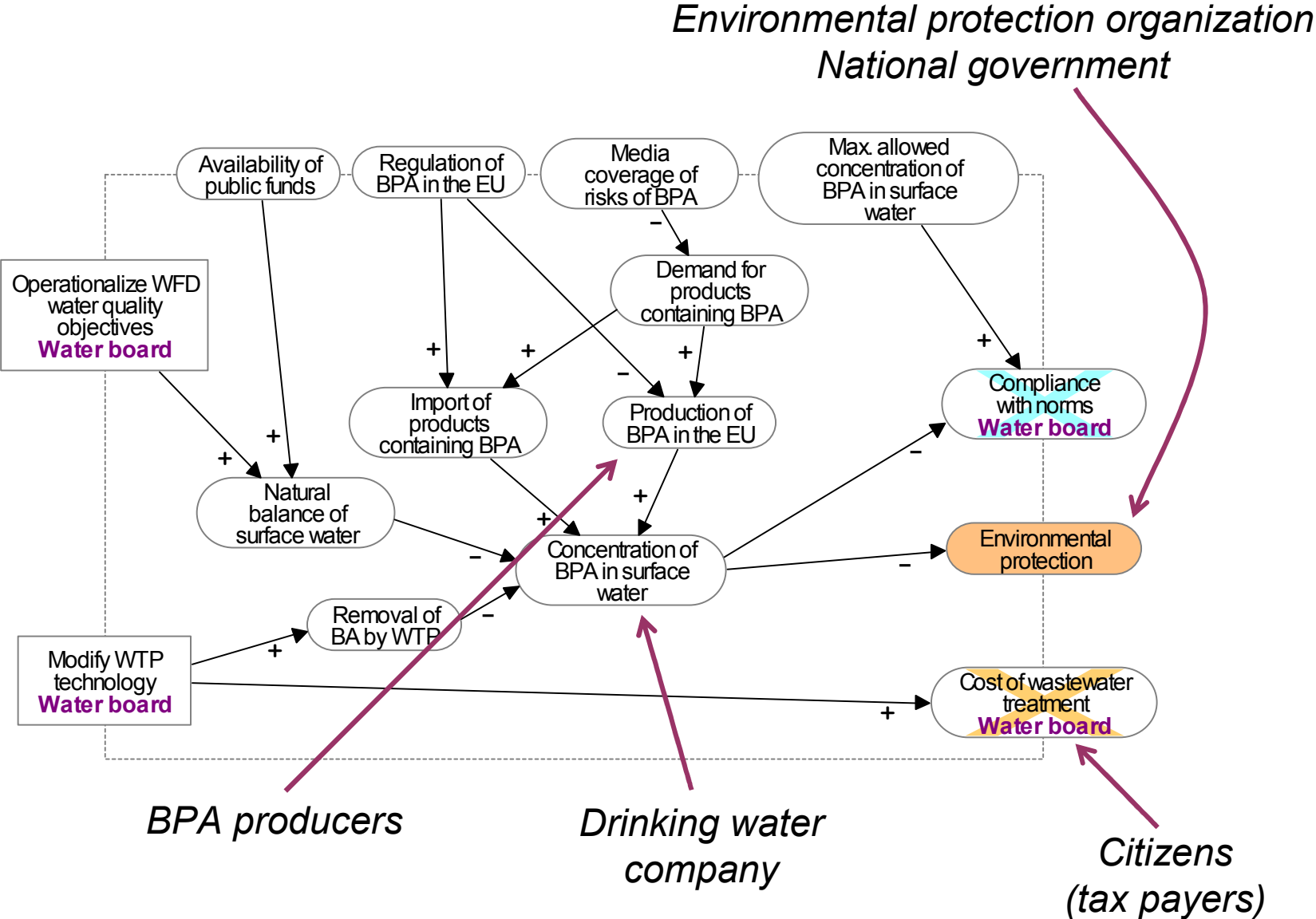
- Regulation of BPA production in EU may not be effective due to imports
- Increasing allowed BPA concentration will make compliance easy
- Media coverage of BPA risks may lower demand and hence emissions



## 4. What actors may help to attain goals?



# 5. What actors take interest in factors?



# Actor analysis:

## Outline problem perception of other actors

### *Example 1:*

<b>Actor</b>	<b>BPA producer</b>
Interest	Continuity as a manufacturer of chemical compounds ⇒ profit
Desired situation/goals	High demand and low production cost ⇒ no restrictions on production/use of BPA
Gap	Demand for BPA is expected to decrease
Causes	Use of BPA in plastics is expected to be restricted
Possible solutions	Scientific evidence that BPA is harmless Develop substitutes for BPA
Resources	Research and development

# Actor analysis:

## Outline problem perception of other actors

### *Example 2:*

<b>Actor</b>	<b>National government (Ministry of Health)</b>
Interest	Ensure public health in The Netherlands
Desired situation/goals	Mitigate health risk of BPA ⇒ very low BPA concentration in drinking water
Gap	BPA concentration in drinking water is increasing in regions where drinking water companies have to use surface water
Causes	BPA concentration in surface water is increasing while BPA is not removed by current purification methods
Possible solutions	Lower BPA concentration in surface water Removal of BPA using new filtering techniques
Resources	Impose stricter quality standard for drinking water

# Summary of findings

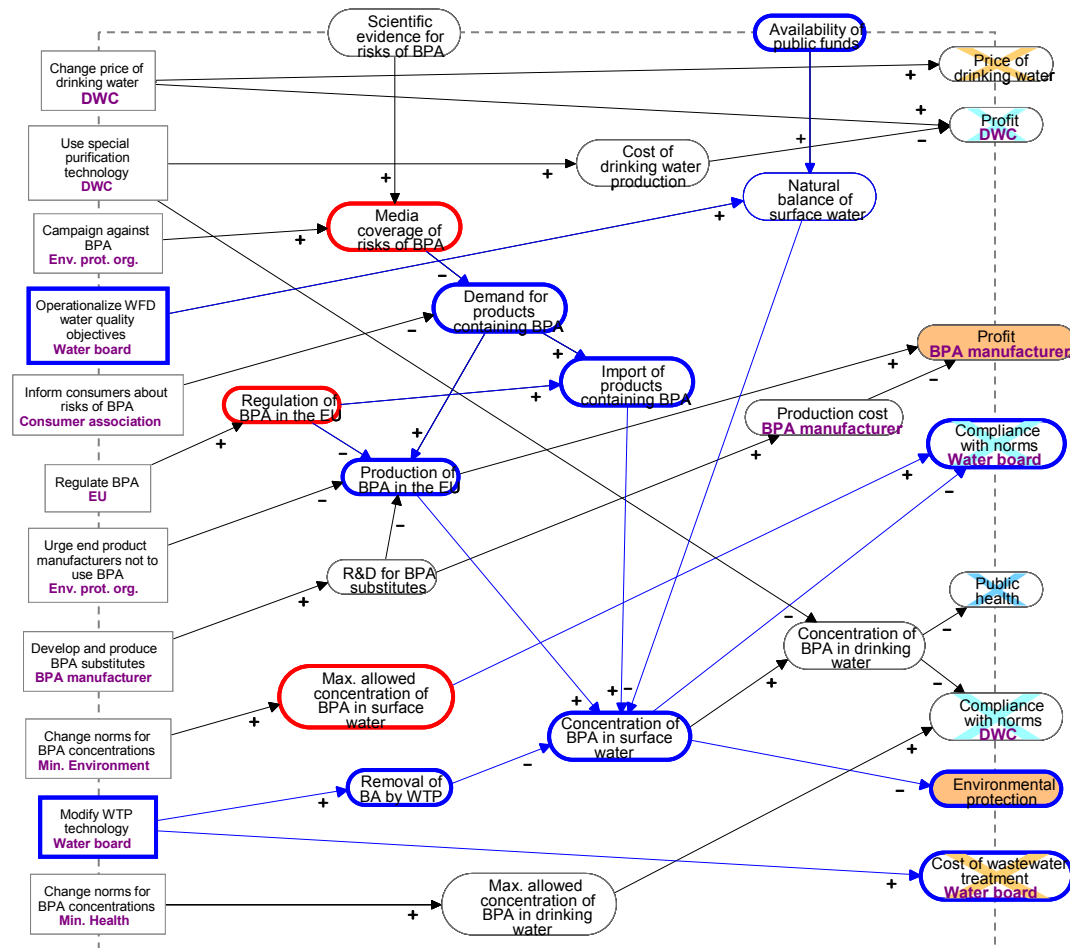
<b>Actor</b>	<b>Objectives</b>	<b>Resources</b>
Water board	Meet quality standards Low cost of WW treatment	Technology (WWTP) Levy tax (cost recovery)
National government - Min. of Environment - Min. of Health	Mitigate BPA risks - for the environment - for public health	Set quality standards - for surface water - for drinking water
Env. prot. organization	No BPA in the environment	Campaign against BPA
European Union	Mitigate BPA risks Healthy plastics industry	Regulate BPA (legislation)
BPA producer	Profit (selling BPA)	Research and development
Drinking water company (DWC)	Meet quality standards Profit (cost recovery)	Purification technology Pricing of drinking water
Consumer association	Consumer awareness of BPA risk	Information to members
Citizens	<i>(diverse)</i>	<i>(as consumer and voter)</i>

# Useful use of an actor analysis

1. See how the client problem is related to other actors' problems
  - Which factors (notably criteria!) are relevant for both client and other actors? ⇒ ***extend the initial system diagram!***
2. Assess "resource dependency"
  - Does the client need other actors to attain his goals?
  - Will the situation improve or worsen (from the client point of view) when other actors act to solve their problem?
3. Assess potential for synergy and conflict
  - What are logical solutions (strategies, policies) and who is needed for their implementation?
  - Who benefits / incurs costs in each strategy?

# Extend the initial system diagram

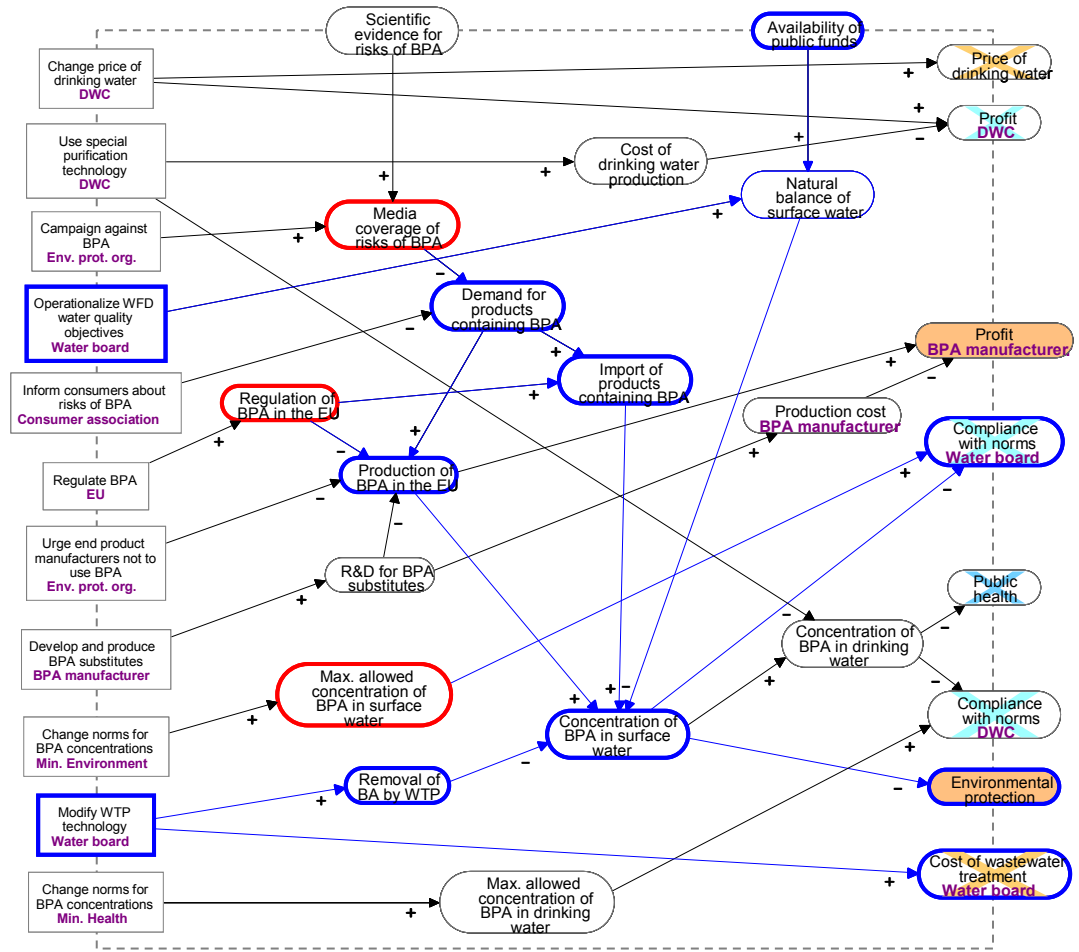
by including instruments and objectives of other actors



Original factors outlined only to show what has changed.  
 Note that some external factors have “moved inside” the system boundary

# See how the issue has been broadened

Many more instruments



drinking water

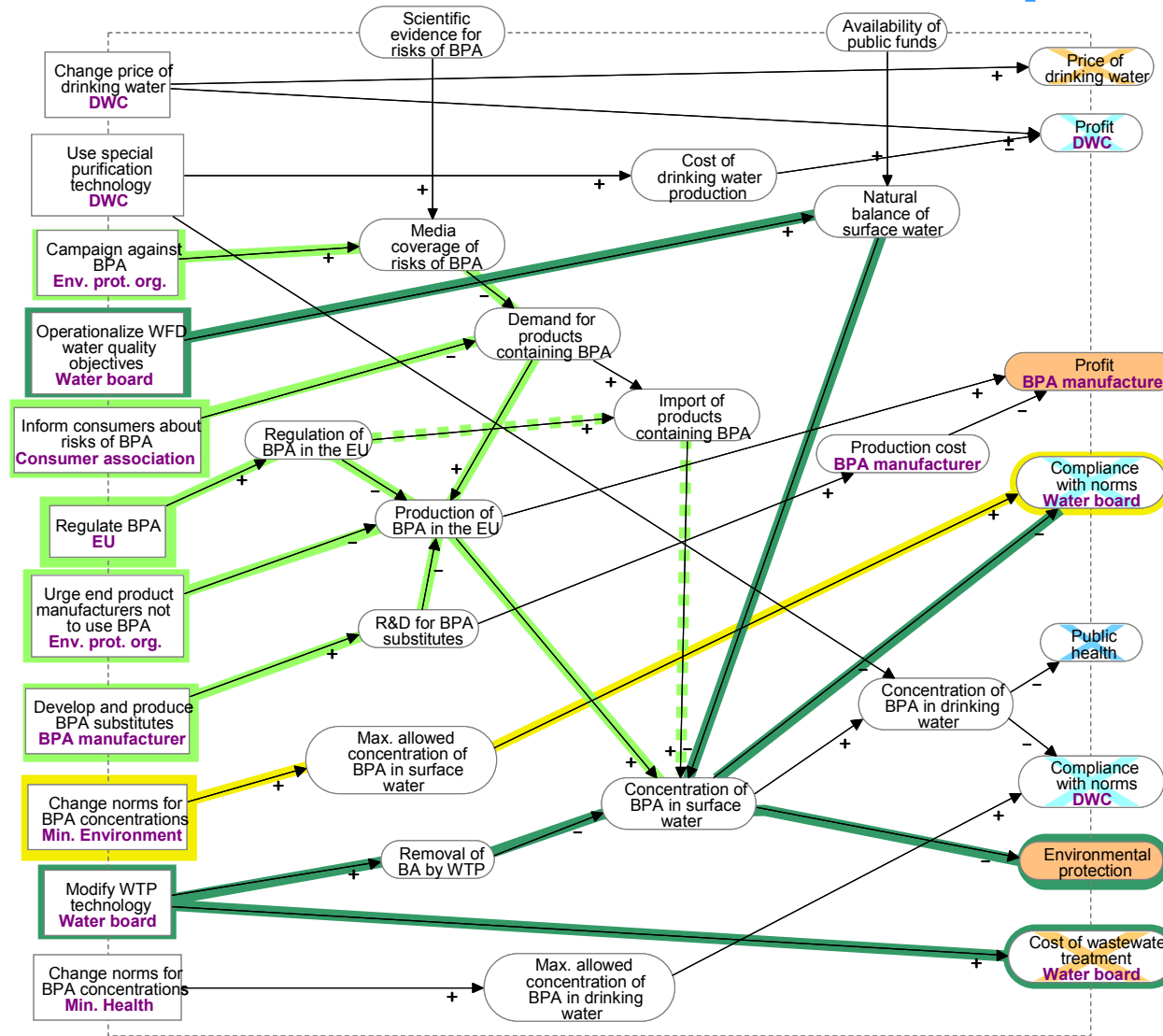
industry & economy

public health



# Assess resource dependency

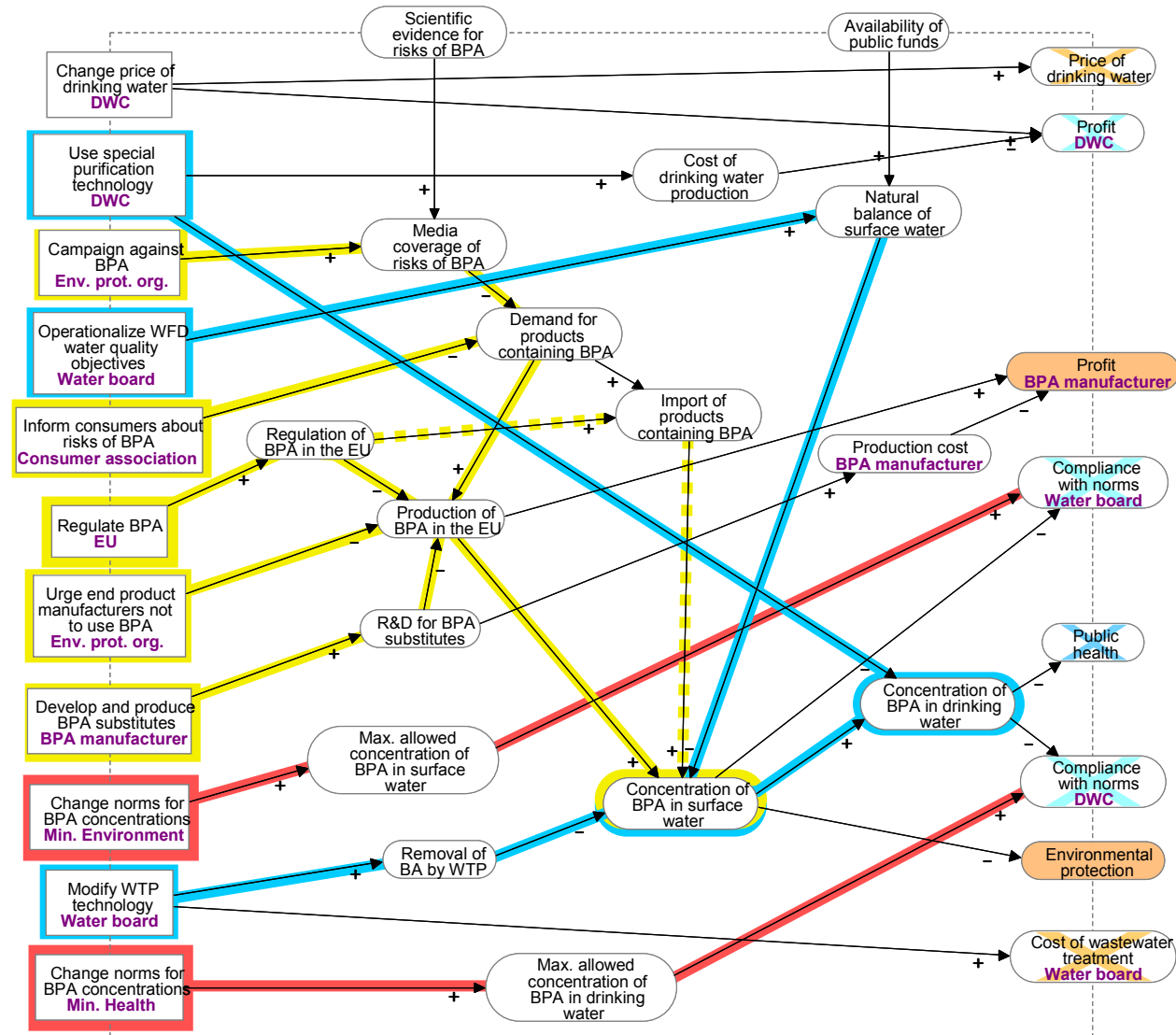
⇒ What actors can affect the client's problem?



Client capability
  Contributes to solution
  May also increase problem

# Look for different solution strategies

⇒ What coalitions are needed for each?



Accept risks of BPA
  Reduce emissions of BPA
  Clean up BPA

# Solution strategies: Actors needed and affected

## ■ Accept risks of BPA\*

Ministry of the Environment  
Ministry of Health

- *resolves problem of water board and DWC*
- *goes against interest of Env. prot. org.*

## ■ Reduce emissions of BPA

European Union  
BPA producer  
NGOs (consumers, environment)

- *resolves problem of most actors*
- *goes against interest of BPA producer*  
*Note: E.U. also has an economic interest!*

## ■ Clean up BPA

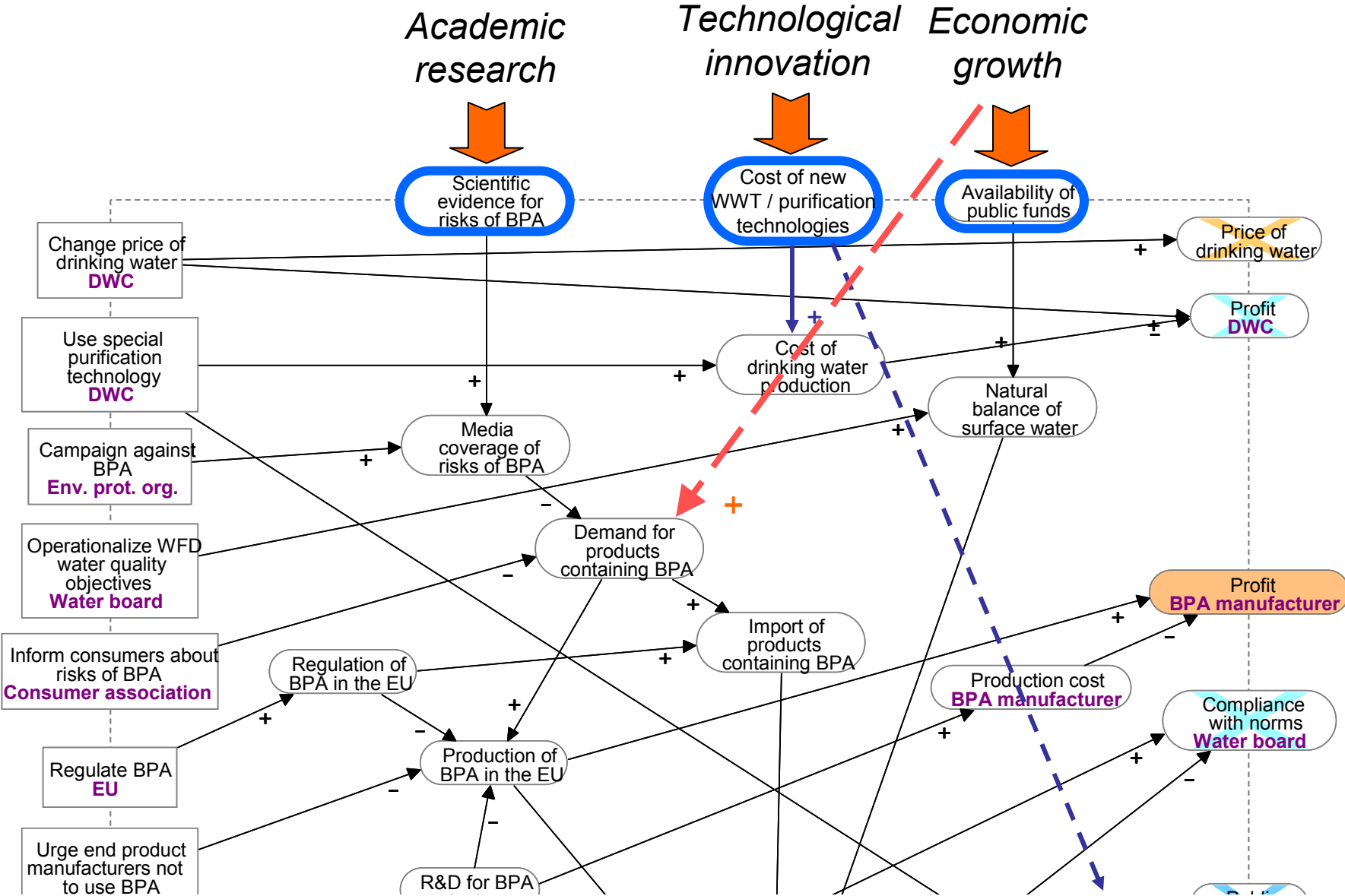
Water board  
Drinking water company (DWC)

- *poses the initial dilemma: improving water quality increases cost  $\Rightarrow$  higher taxes and higher price of drinking water, which go against interest of citizens/consumers*

\*Note that European legislation may prohibit this strategy, overruling national government

# Assess uncertain external influences

## ⇒ Driving forces

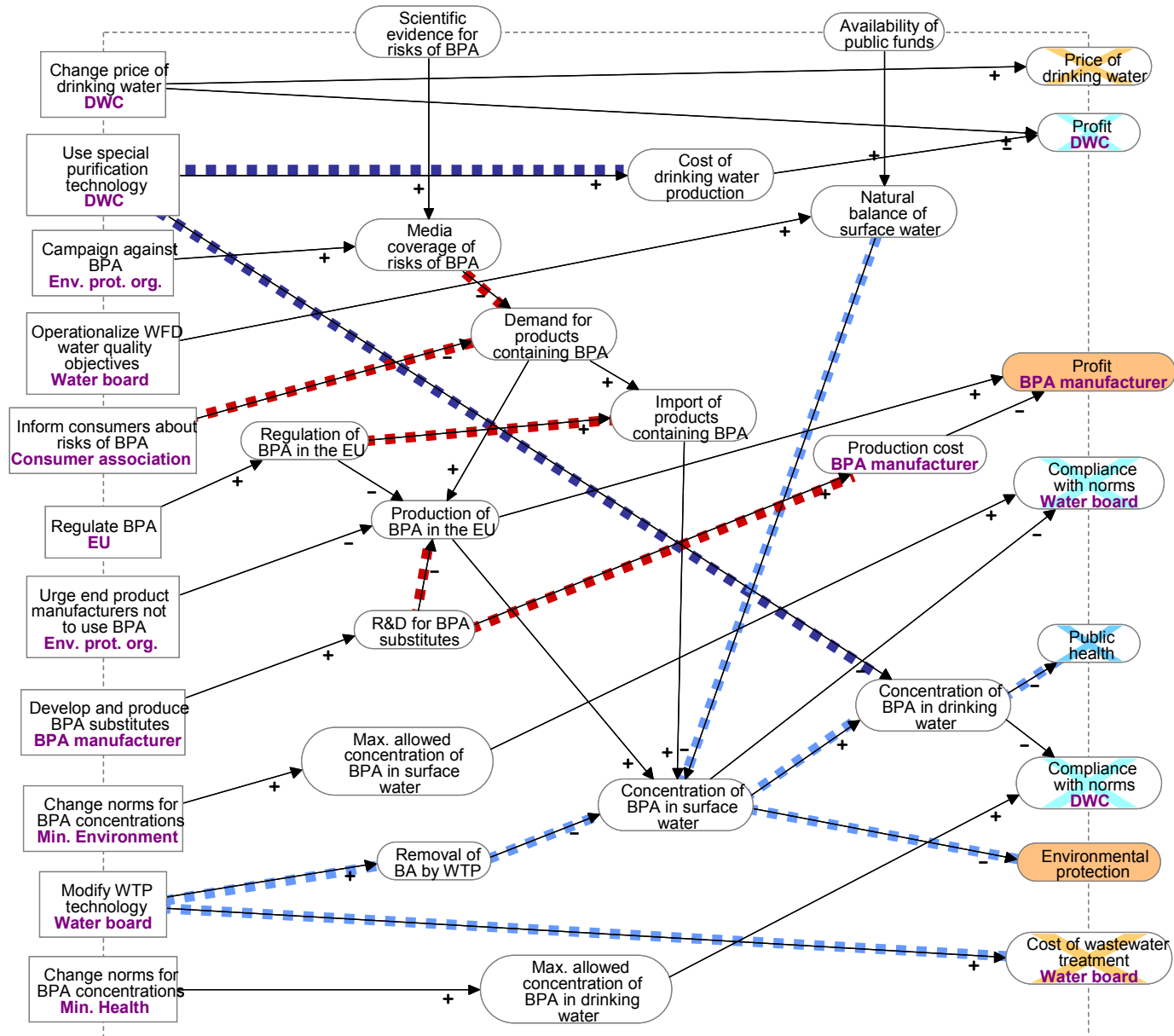


# Scenario analysis (example)

- “Filters (almost) for free”
  - Little or no new scientific evidence
  - Major break-through in WWT technology
  - No recession
- “Regulate or perish”
  - Evidence for high health risks
  - Little or no technological innovation
  - Low economic growth
- “Booming business as usual”
  - No new scientific evidence
  - Little or no technological innovation
  - High economic growth

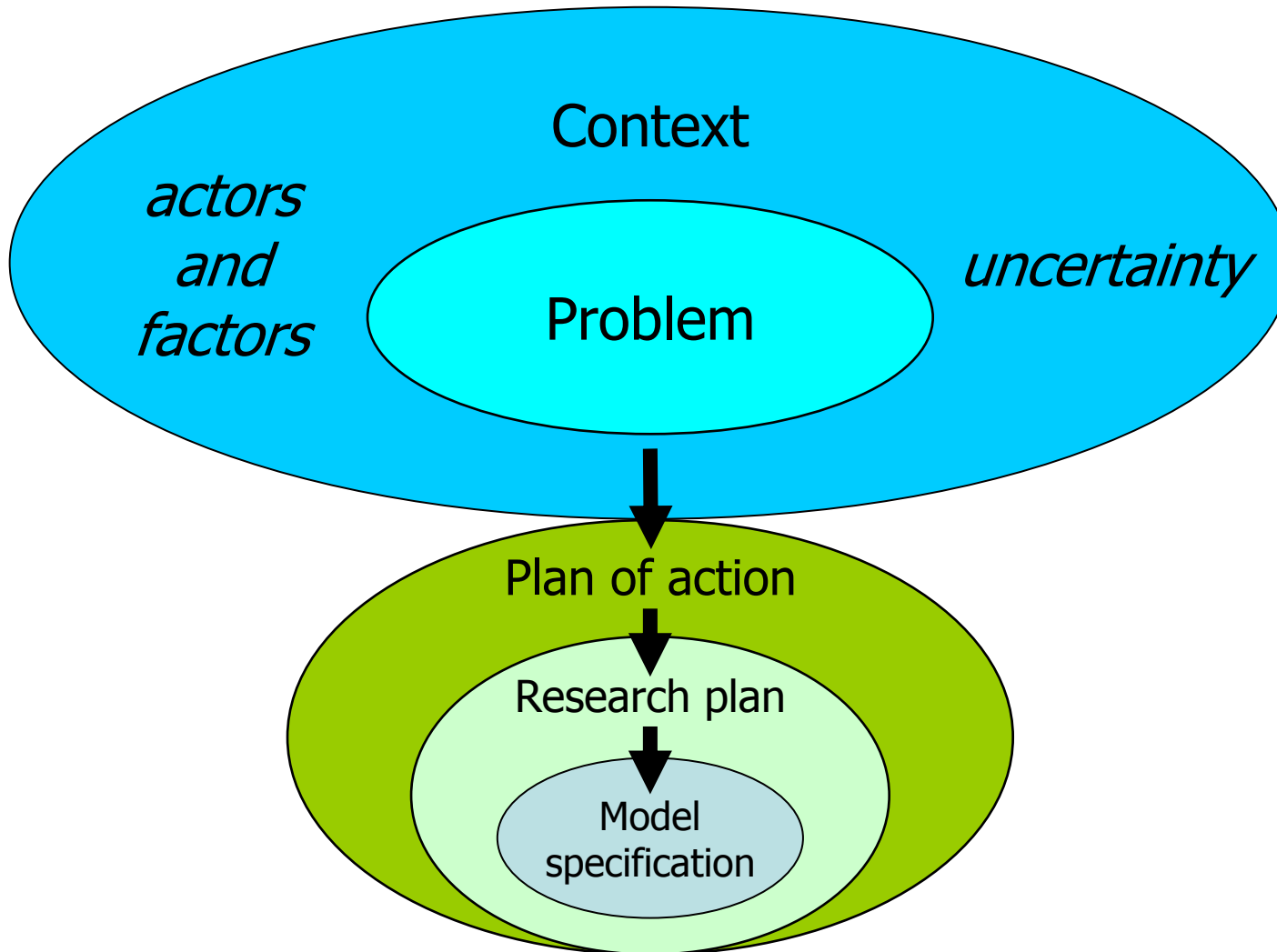
# Look for knowledge gaps

⇒ What relevant causal relations are uncertain?



# So what?

⇒ Recall our “leading thread”



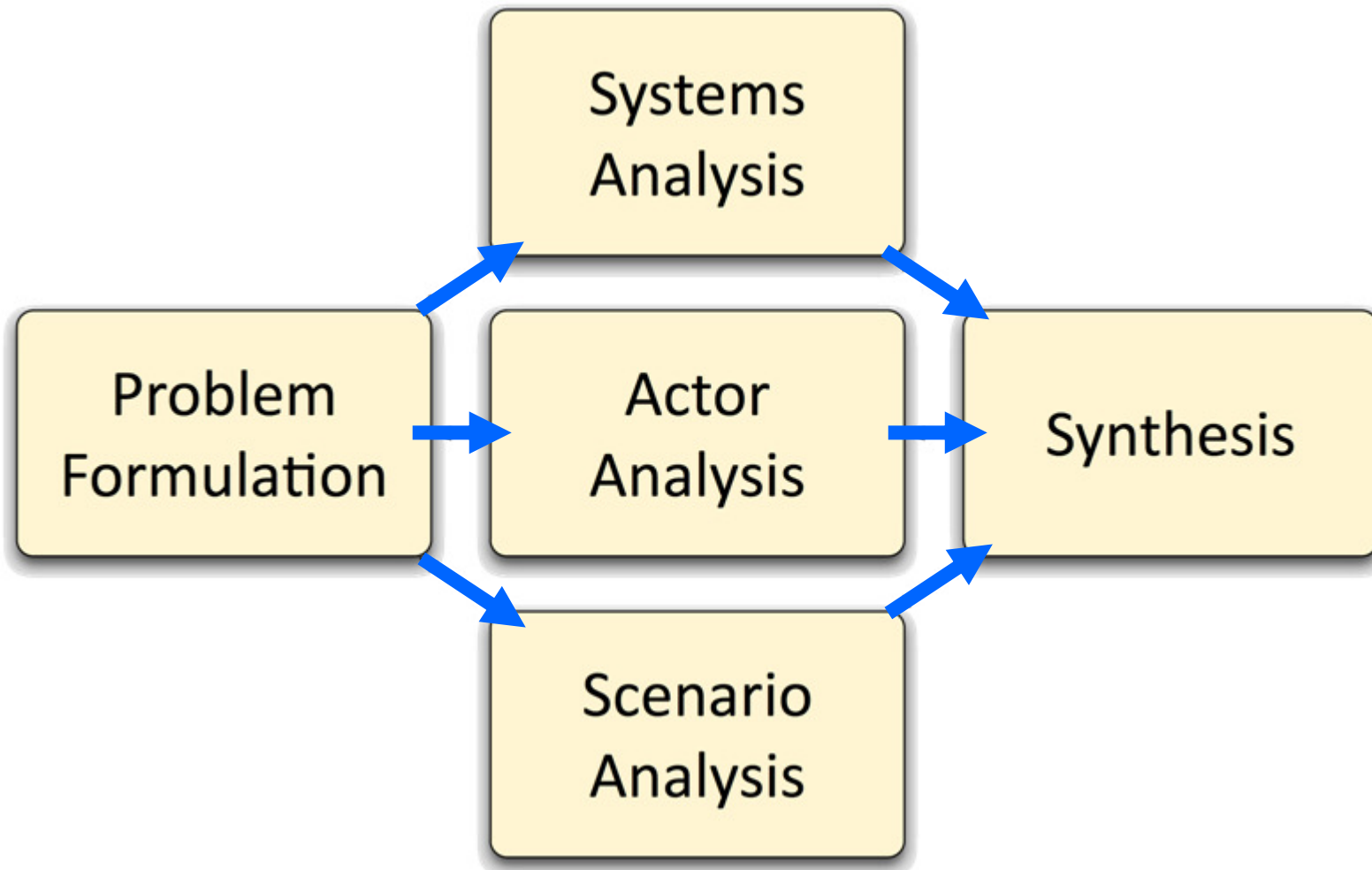
# Structure of an issue paper (cont'd)

1. Introduction ✓
2. Problem analysis
3. Plan of action + research plan
4. Appendices

***Checklist for a good issue paper:  
Reader pages 163-165***



## Part 2: Problem analysis



## Part 2 needs a “story line”

Your issue paper must convince the client:

- (s)he should be able to identify him/herself within the situation you describe ⇒ *introduction*
- the narrative should bring each of your findings to the fore in a logical sequence ⇒ “*story line*”
- the story should be about the **client** (problem owner), **not** about you (analyst)!

*Try this for the Bisphenol-A example*

## Part 3:

# Plan of action plan + research plan

- Plan of action:
  - outlines what the client should do to move forward:
    - actors to involve and/or inform (+ ways to do that)
    - decisions to make (+ required knowledge)

- Research plan:

- Explains how new knowledge will contribute to the problem solving process
- Clarifies which knowledge gaps will be filled
- Justifies methodological choices
- Outlines methods and models that will be used/constructed
- Provides a time schedule and cost calculation

*Why?*

*What?*

*How?*

*When?*

# What kind of research?

## Common types of knowledge gaps:

- *Relations between factors??*
  - How (strongly) does the value of X depend on the values of Y and Z?
  - What is the probability that E will occur when C occurs?
- *Dynamic system behavior??*
  - How quickly do changes occur / propagate?
  - (When) will the system converge to an equilibrium?
- *Preferences of stakeholders??*
  - What weights to assign to criteria?
  - How high is the “willingness to pay”?
- *Costs and benefits of policy options??*
  - How big (effectiveness/efficiency) and for whom (equity)?

# Relations between factors

- $Y = f(X_1, X_2, \dots, X_n)$ 
  - Empirical data available  $\Rightarrow$  regression analysis
  - No empirical data  $\Rightarrow$  theory-based simulation model + “Turing test”
- Conditional probabilities
  - Large data set available  $\Rightarrow$  Markov models
  - No empirical data  $\Rightarrow$  Bayesian belief networks based on expert opinions

# Dynamic system behavior

- High aggregation level, relatively long time line and dynamic behavior as the result of positive and negative feedback  
⇒ System Dynamics (stocks, flows, differential equations)
- Low aggregation level and dynamics caused by (rule-based) interaction between numerous discrete entities  
⇒ Discrete event simulation

# Preferences of stakeholders

- Eliciting weights to assign to criteria
  - various panel methods
  - conjoint analysis
  - Analytic Hierarchy Process (pair-wise comparison)
- Assessing “willingness to pay”
  - direct questioning
  - bidding games
  - conjoint analysis

# Elaborating research questions

- Operationalize factors as variables
  - factors such as “water quality” and “WTP efficiency” are not specific enough
  - provide clear definitions and measurement scales
- Operationalize (causal) relations
  - as hypotheses
  - as parameterized equations
- Identify your data sources
- **Justify your methods!!**



# Main points of this lecture

- The **purpose** of an issue paper
- What are **useful** applications of analytical methods
  - Linkages between systems analysis and actor network analysis
  - Questions you can answer with the help of your diagrams
- How to identify relevant **knowledge gaps**
- Why you need a convincing “**story line**”
- The **ingredients** of a research plan
- Some common types of **research question** and appropriate methods

## Coming up next:

- This week's tutorial (Thursday):
  - Presentation of scenario logics
  - Start with storylines
- Next lecture (Tuesday 26 May 2009):
  - Research methods & mathematical modelling

***Thank you for your attention!***