Towards a comprehensive framework to govern the main sustainability issues of inland industrial complexes

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Inland industrial complexes – Highveld Industrial Complex

- Serious threat of water shortage and deterioration of water quality
  - MDG goal carrying capacity of 1000 m^3/head/annum exceeded
  - Cost of treating water is increasing

- But this may be outweighed by perceived social and economic benefits
  - Continual government support for such complexes

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Inland industrial complexes – Highveld Industrial Complex

- It will become very important that the negative consequence, for present and future generations, should be taken into account in a comprehensive manner to ensure that the complexes are properly governed
  - From the planning phases throughout their operational life
- Geographical sub-complexes; Coal mine to petrochemical; Coal mine to electricity; Gold mine to gold concentrate, three tiers of governance and service delivery; urban society-light industries; rural communities and agriculture

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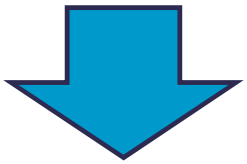
Research question – Governance component part of the larger WRC Industrial Ecology study

- What constitutes sustainability to govern inland industrial complex, and how could the sustainability be modelled and improved?

- Other studies on key factors affecting sustainability of the complex
  - Industrial salt water usage and wastes (with CSIR/UKZN/UCT)
  - Surface water salt loadings (CSIR)
  - Sources and destinations (including storage) (CSIR/UKZN)
  - Integrated technologies (UCT/CSIR)

Research objectives #1 – of this component of the larger WRC study

- Determine what constitutes the sustainability of an inland industrial complex with respect to governance issues
  - What sustainability includes, and for whom, and why sustainability is pursued, so that the goals for various stakeholders can be defined

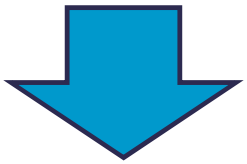


Define the most important criteria or indicators, that can be used to evaluate the extent to which sustainable development is achieved, in a hierarchical tree

Literature analysis and stakeholder engagement

Research objectives #2 – of this component of the larger WRC study

- Investigate the relationships between the endogenous variables (within the system), and the exogenous variables (out side of the system)
  - Relate these to the hierarchical tree

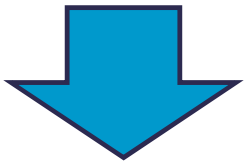


Define a system diagram that stipulates the boundaries and specifies the key variables and how these may be measured with the criteria and indicators

Questionnaire and detailed stakeholder interviews

Research objectives #3 – of this component of the larger WRC study

- Analyse the network of involved parties, as a basic cause and effect model, to describe the relationships between the involved parties that could provide insight into interdependencies
  - Stakeholder analysis



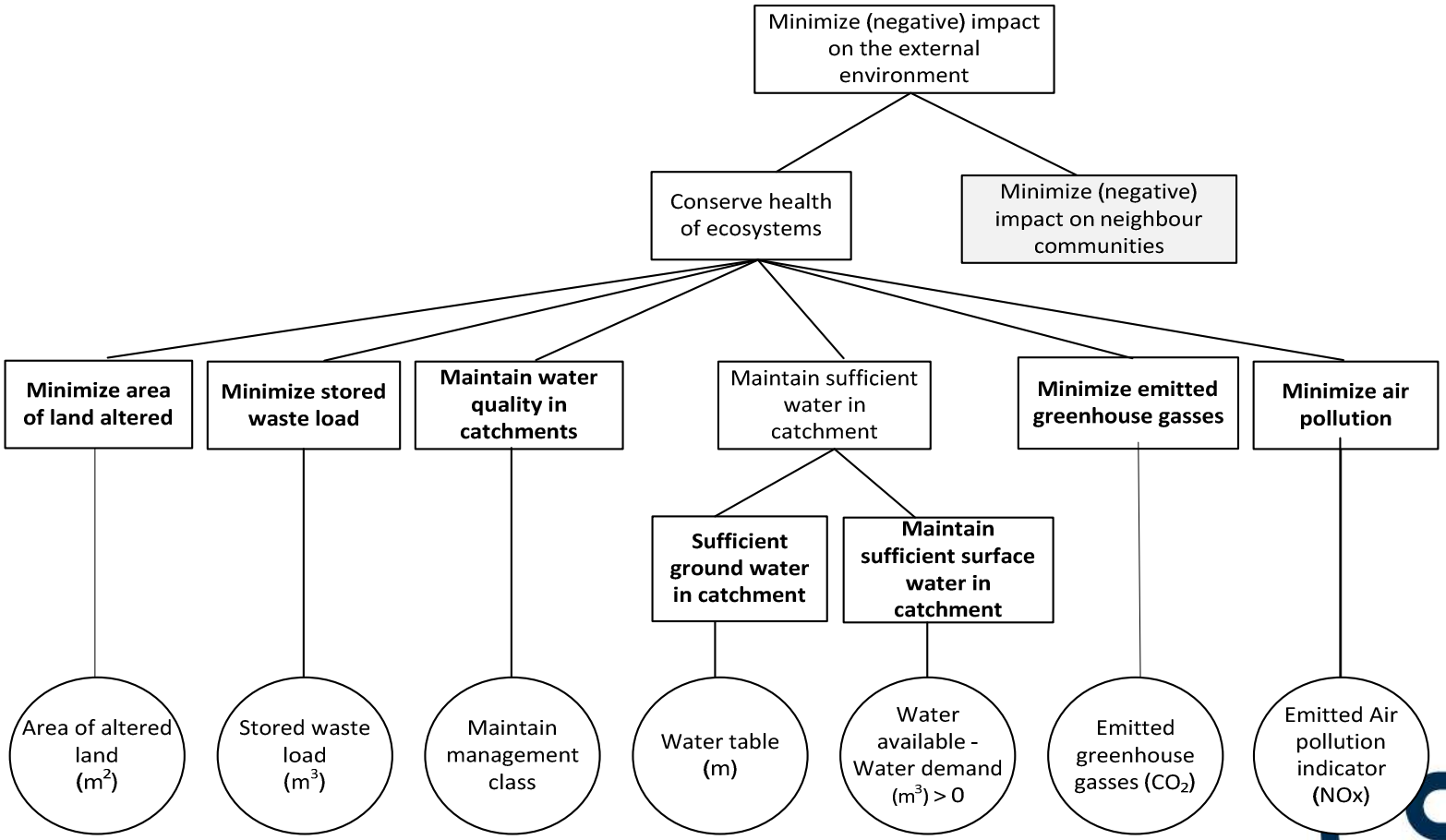
Develop (initial) causal-loop diagrams that can be used to ascertain the causes of policies, and other behaviours, such as institutional arrangements

Questionnaire and detailed stakeholder interviews

Research objectives – in summary

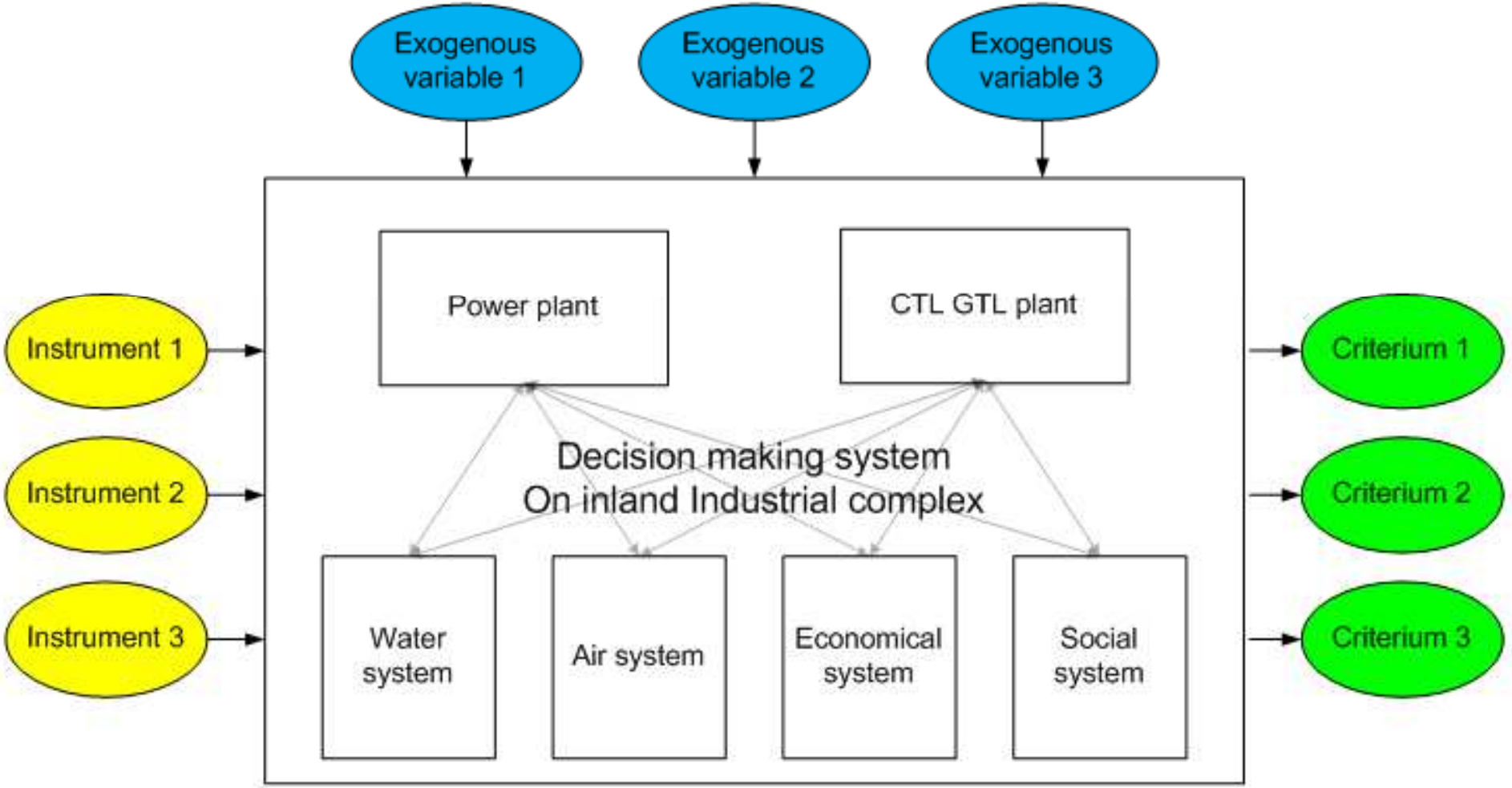
- Is to investigate what the main sustainability issues are when governing large inland industrial complexes, whereby recommendations can be made to improve such governance
  - Rather than an exact, quantitative model to measure the sustainability of an inland industrial complex, a qualitative framework to guide further quantitative modelling efforts has been developed

Research objectives #1 – the hierarchical tree of criteria/indicators



DR2

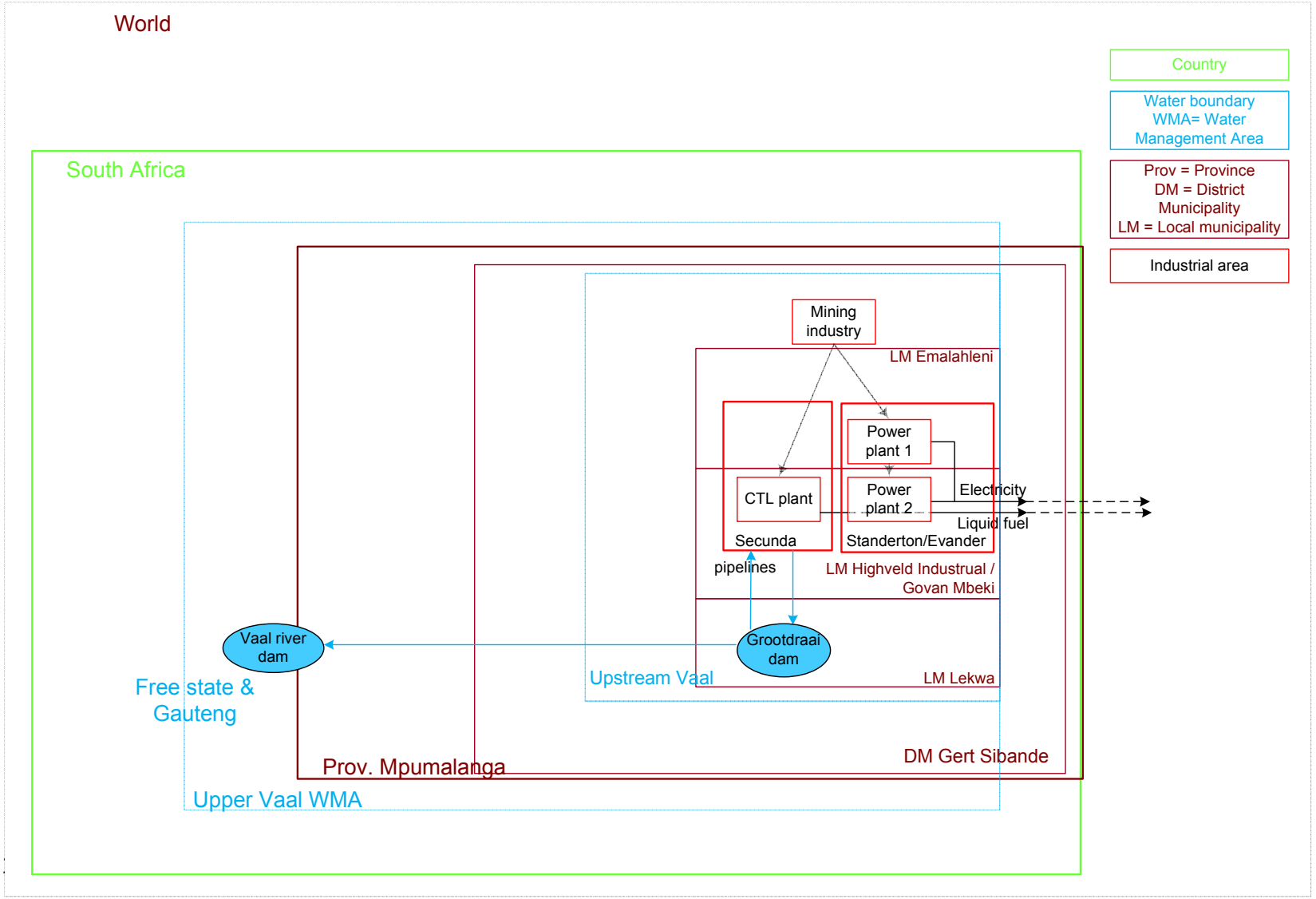
Research objectives #2 – the system diagram (overall)



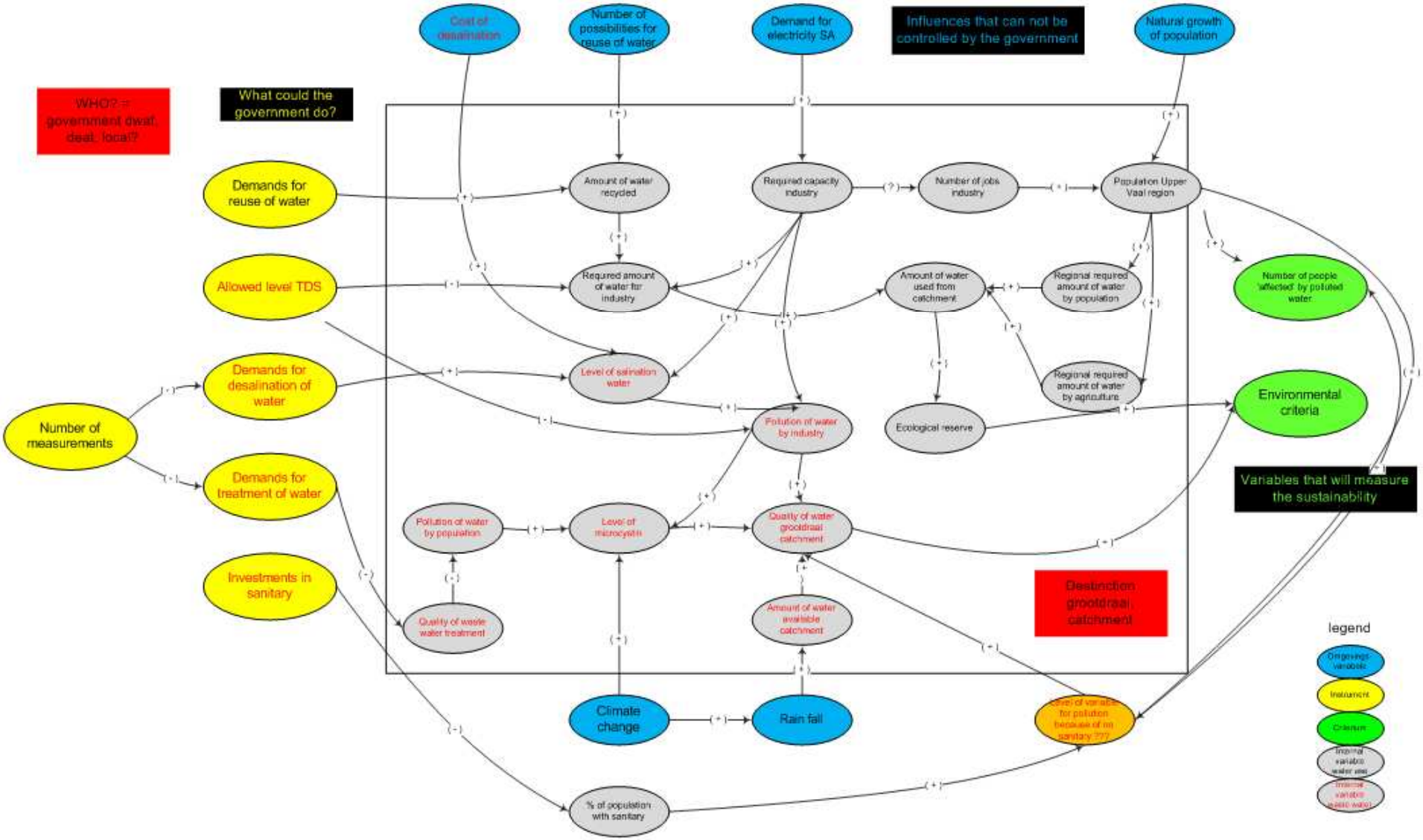
Slide 10

DR2 other governance parties in complex solution are:
Govan Mbeki LM
Gold Mine
Coal Mines
CTL/GTL/Fertilizer/Explosives/Plastics
Agriculture
D Rogers, 20/04/2010

Research objectives #2 – the system diagram (boundaries)



Research objectives #3 – the causal-loop diagram (water system)



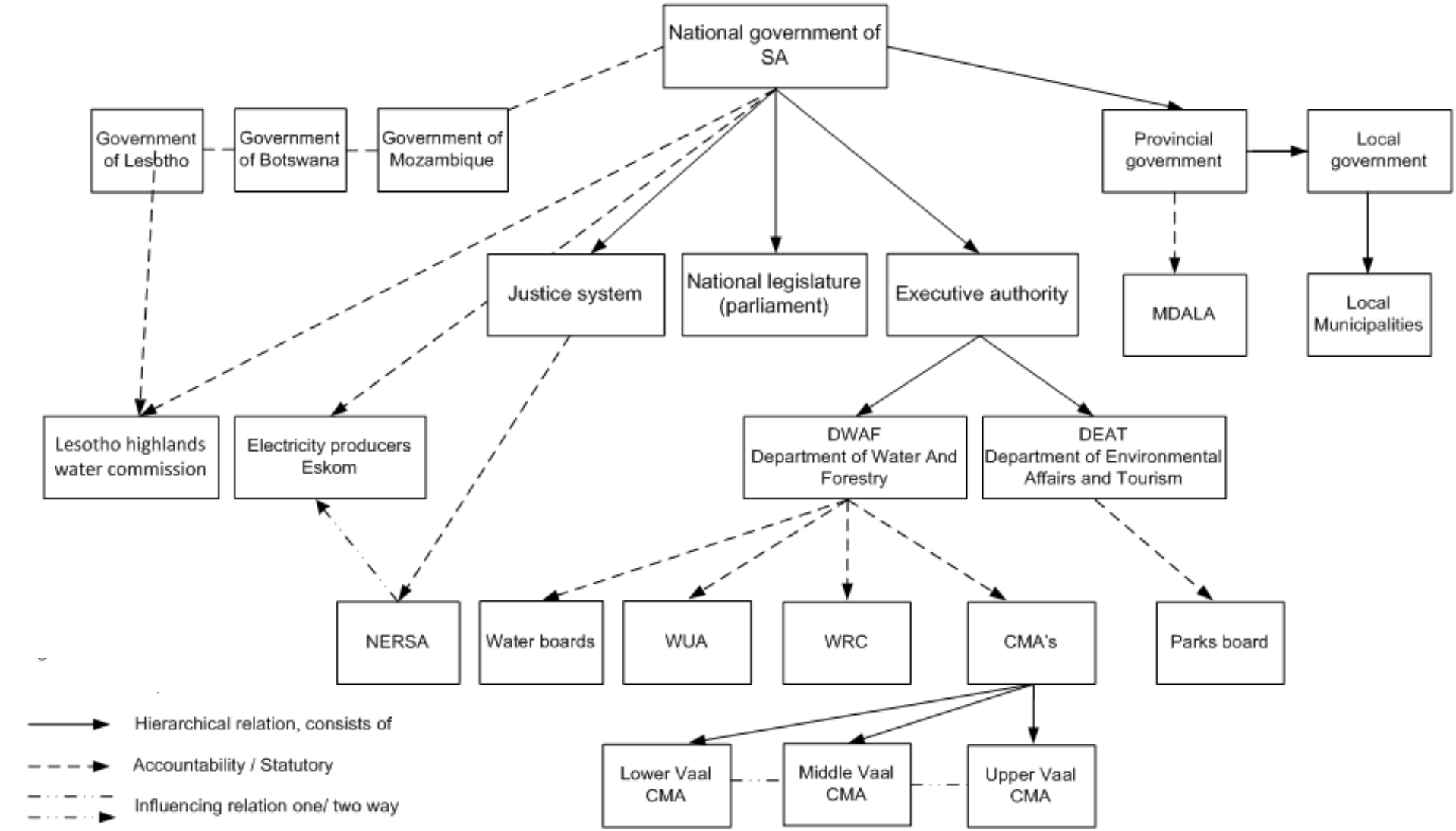
DR6

Research objectives #3 – the stakeholder analysis (major users)

Slide 13

DR6 alan/godfrey
this slide needs to be redone
1. lekwa/nkangala/matla ares not in the case study area
perhaps use the map from our report (I will attach that separately)
2.Mining Gold/coal industry - these are different governance sectors (DM) from power/fuel industry DoE, and petrochemical DTI.
3. unserviced households:water & sanitation are main issues for pollution and water use allocations in government policy (backlog is of the order of 80% in GMbeki (Estimate 2008 CSIR Mpu IPC report)
D Rogers, 20/04/2010

Research objectives #3 – the stakeholder analysis (governance policy)

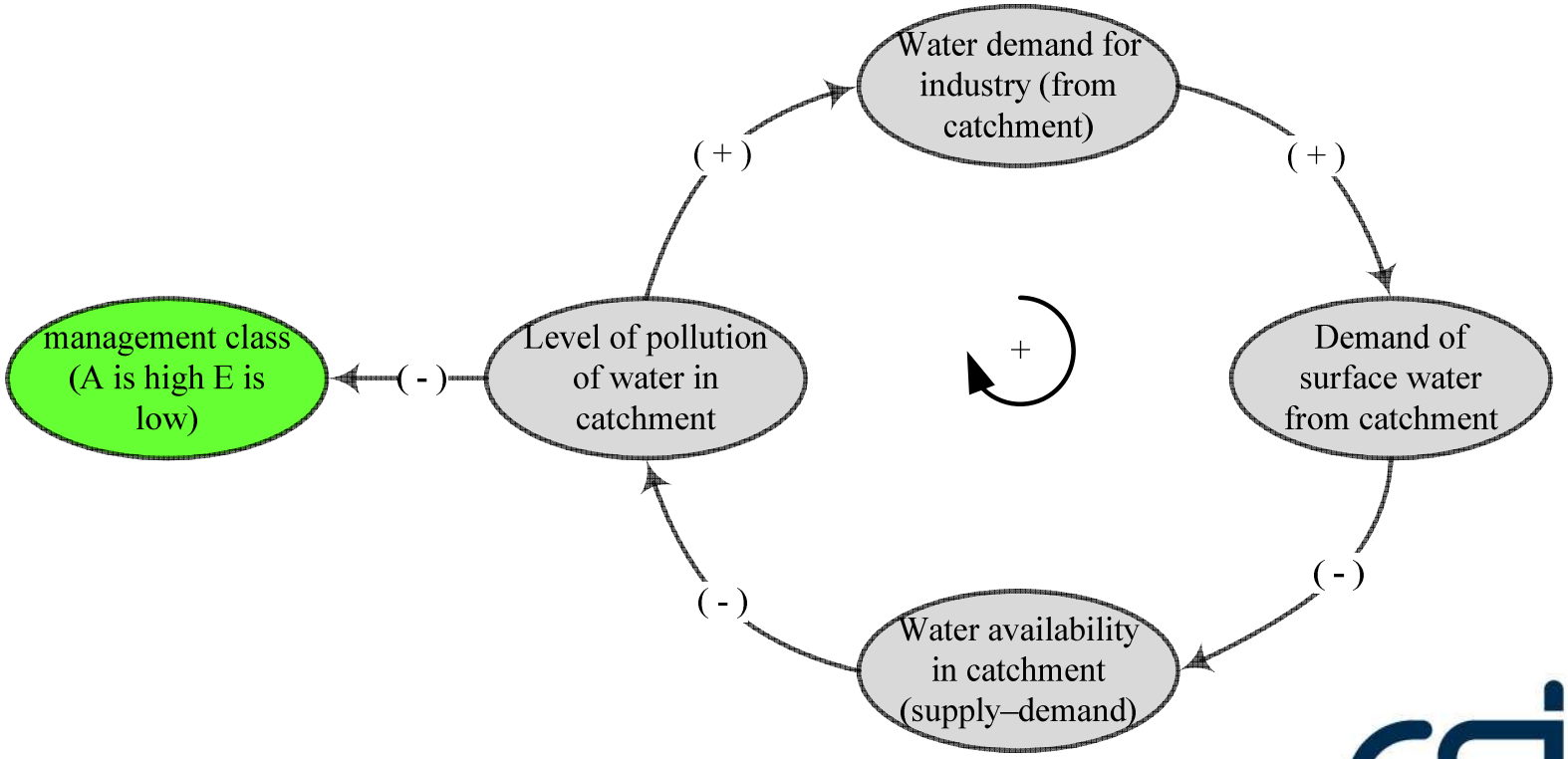


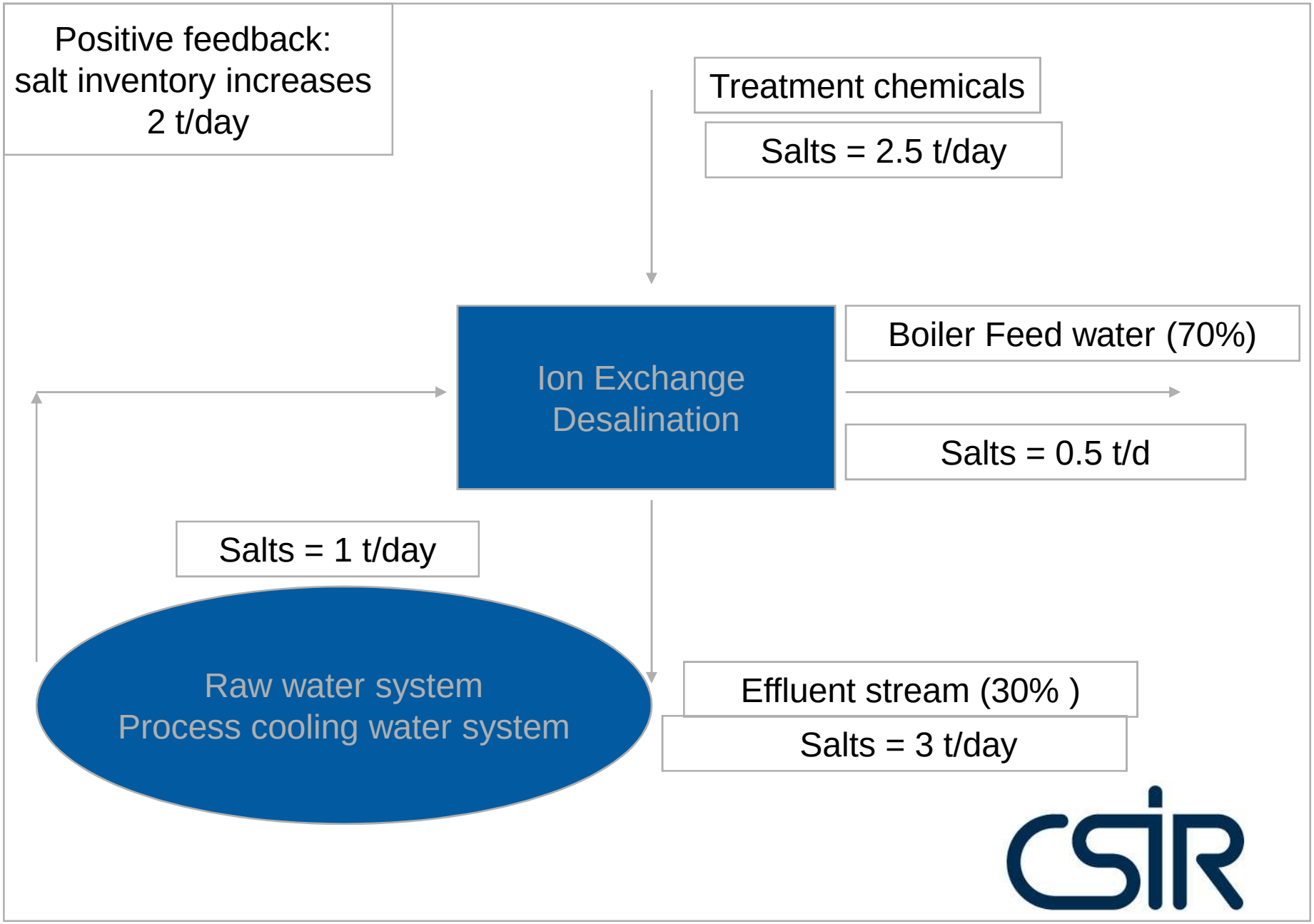
Discussion of findings

- Water desalination
  - Increases the amount of salt waste
  - Increases specific water use
  - Increases specific energy use
- Decision (lag) time reduces action
  - Increases co-operative governance complexity
  - Increases boundary
  - Reduces opportunities for cooperation inside the complex

Discussion of findings – Water quality positive feedback loop

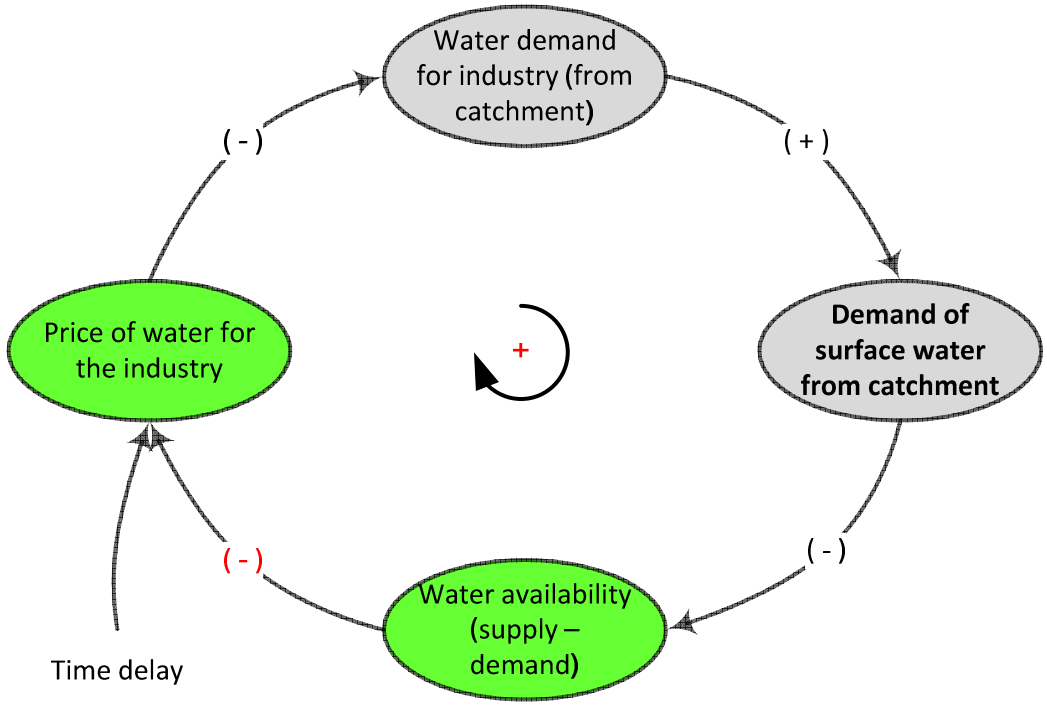
- If water is polluted more, then industry uses more water





Discussion of findings – Water quantity feedback loop

- If water is scarce, the price does not go up under free market conditions, and there is a time delay to adapt the price of water to the scarcity



Principles underlying governance and IE - Brent et al. (2008)

- Level 1
  - Constitution
- Level 2
  - Material and energy flow limits and thresholds of ecological sustainability
- Level 3
  - Planning principles and constructs for systems planning
- Level 4
  - Suggestions for material flow reduction, redirection, recycling, reuse avoidance
- Level 5
  - Tools to monitor and audit

Acknowledgement

- WRC for financial assistance and guidance
- The Reference Group of the WRC Project K5/1833/3 for the constructive discussions during the duration of the project
- All stakeholders in the Highveld Industrial Complex for the supply of data and information
- The CSIR for the support
- Stellenbosch University for the support
- Technical University of Delft, the Netherlands for a Masters student

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