Use of System Dynamics for Decision Analysis: A Case Study in Water Resource Assessment

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• Sustainable decision making needs contextual understanding and analysis of water resources systems.

• A systems approach provides a holistic understanding of issues and facilitates conceptualizing of the problems.
System Dynamics

- Reinforcing loop
  (+) means changes in the same direction

- Balancing loop
  (-) means changes in the opposite direction
An archetype is made of a specific combination of reinforcing and balancing loops

(Braun, 2002)
System Archetypes

- Archetypes describe dynamic phenomena and “common stories” that occur repeatedly in the diverse sets of behaviour and contexts in the system.

“Certain patterns of structure occur again and again”
Why Archetypes?

Recognising archetypes:

• gives decision makers insights into potential future consequences and side effects of policy decisions
• understanding the root causes of a challenge
• can be used as a model conceptualization technique
• The first step to breaking the dynamics of an archetype is to recognize them, their causes and consequences.
Gorganroud-Gharesu Case Study
Gorganroud-Gharesu Economy

- Services (tourism)
- Agriculture
- Industry
Methodology

Pre-assessment of problems (Field visit, report, interviews)

Casual Loop Diagrams

Fact check

Archetypes
Gorganroud-Gharesu problems

The issues (gained from reports, expert interviews)

1. Growing water demand
Gorganroud-Gharesu problems

2. Land use changes
Gorganroud-Gharesu problems

3. Flood
4. Damages
5. Sediment
1. Growing water consumption problem
1. Growing water consumption problem (Limits to growth archetype)
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2. Supply-demand mismatch problem (Fixes that fail archetype)
Supply-demand mismatch problem (Fixes that fail archetype)

Water shortage → B → Water supply → Regional utility → + R1 → + Water Consumption behavior → - Consumption pattern → + Regional utility → - Water shortage

Graph showing the change in hectares over years for different categories:
- Agriculture
- Industry
- Service
- Total Water consumption


Hectars: 0, 200, 400, 600, 800, 1000, 1200, 1400, 1600, 1800
Flood problem (Fixes that fail archetypes)

Government investment trend in water resources development projects

Billion Rial (Iranian currency)

Percentage

1990
2001
We cannot solve our problems with the same thinking we used when we created them.

*Albert Einstein*

The main problem of the Gorganroud-Gharesu Basin is the lack of integrated approach rather than piecemeal ones in solving the problems.
Thank you

Questions?

Golestan Forest, Gorgan, Iran