(a)

Agent Population
Natural-language reasoning
78 irrigators or 100 households

Proposed action
+ reasoning

Retry
(violated rule)

Decision
context

Institutional Governance
*Physical + institutional +
behavioural rules*

Environmental Context
*Drought index, water rights,
neighbour decisions*

Validated
action

Updated
state

Simulation Engine
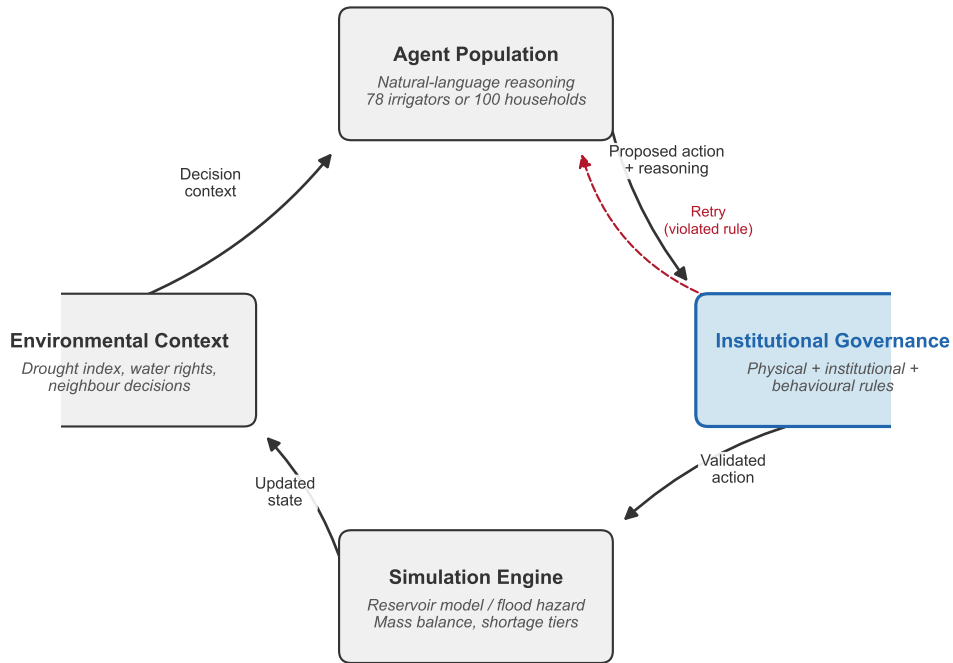*Reservoir model / flood hazard*
Mass balance, shortage tiers

Each time step: every agent proposes an action; institutional rules validate it;
the simulation executes validated actions and returns updated environmental signals.

(b)

Governance pipeline (six-step institutional rule validation)

Agent
proposal

Step 1	Step 2	Step 3	Step 4	Step 5	Step 6
Format check	**Action-vocabulary check**	**Physical feasibility** *Mass balance, capacity limits*	**Institutional compliance** *Prior-appropriation rules, programme eligibility*	**Magnitude plausibility** *Rate-of-change bounds (±15 %/yr)*	**Theory consistency** *Appraisal–action alignment*

Validated
action

Retry with
feedback

A1 ablation: demand ceiling removed

Decision audit trail
All proposals, reasoning traces, and rule violations recorded