

CPAF v6 — Validation Report

A static record of the model's validation suite, so the results can be read without running the tool. CPAF is validated as a theory-driven structural model with illustrative parameters — not as an empirically-calibrated forecaster. What is tested is the soundness and transferability of the structure and the qualitative reproduction of a real sector's patterns, not the numerical prediction of outcomes.

Scope of validation

These are the subset of the Barlas (1996), Forrester–Senge (1980), Sargent (2013) and Saltelli (2004) tests that suit a structural model with declared parameters. Tests requiring empirical time-series, statistical fit to historical data, or predictive accuracy are deliberately excluded — they do not apply to a structured-reasoning instrument. The suite runs in three stages across three regimes (a high-extraction case, a low-extraction case, and a synthetic neutral case), so a pass is a property of the structure, not of one calibration.

Result: 15 / 15 structural tests (Stages 1–2) · 6 / 6 demonstration tests (Stage 3) · 21 / 21 overall.

Stage 1 — Direct structure (is the model built right?)

The accounting closes, quantities stay valid, and each relationship points the right way. Run across all three regimes.

- **R1 · Conservation** — the producer segments always sum to the whole. *Barlas 1996; Forrester & Senge 1980. Pass.*
- **R2 · Boundedness** — every quantity stays in range and finite; no impossible or runaway values. *Barlas 1996; Forrester & Senge 1980. Pass.*
- **R3 · Extraction suppresses outcome** — higher extraction lowers the producer's outcome; the relationship points the right way. *Barlas 1996. Pass.*
- **R4 · Capability needs access (complementarity)** — capability without market access underperforms capability plus access; they are complements. *Barlas 1996. Pass.*
- **R5 · Coordinated $\geq$ isolated (synergy)** — coordinated interventions deliver at least as much as the same interventions in isolation. *Barlas 1996. Pass.*
- **R6 · Fragmentation friction present** — stacking interventions does not keep raising delivery coherence; friction offsets it (the paradox). *Barlas 1996. Pass.*

Stage 2 — Structure-oriented behaviour (does the structure produce sound dynamics?)

Sensible behaviour at the extremes, the right qualitative shapes, stability, ordered regime change, and hysteresis. Run across all three regimes.

- **B1 · Two stable regimes exist (multistability)** — a low trap and a high regime, both genuine attractors. *Barlas 1996; Scheffer 2009. Pass.*

- **B2 · Threshold classification correct** — a low outcome reads as the low regime. *Barlas 1996; Scheffer 2009. Pass.*
- **B3 · Ordered transitions** — transitions go low → mid → high in order, never skipping the middle. *Barlas 1996; Scheffer 2009. Pass.*
- **B4 · Hysteresis** — escape requires a sustained crossing before the regime is confirmed. *Barlas 1996; Scheffer 2009. Pass.*
- **B5 · Gradual (ramped) response** — intervention effects ramp up over time rather than switching on all at once. *Barlas 1996. Pass.*
- **B6 · Convergence to a bounded attractor** — from any starting point the system settles to a bounded resting state. *Barlas 1996. Pass.*
- **B7 · Stochastic robustness** — qualitative conclusions survive a $\pm 15\%$ random perturbation of the parameters (Monte-Carlo). *Saltelli 2004; Barlas 1996. Pass.*
- **C1 · Coordination critical-mass threshold** — cluster investment builds the co-op past a tipping point; without it, it stays near the floor (a threshold model, invariant to the starting point). *Barlas 1996; Scheffer 2009; Granovetter 1978. Pass.*
- **C2 · Robust across the admin grid** — no in-bounds admin setting overturns the co-op-building behaviour; it is not an artefact of one calibration. *Barlas 1996; Saltelli 2004. Pass.*

Stage 3 — Behaviour pattern (does it reproduce a real sector's patterns?)

Shown on the handicrafts case — domain-specific, and the proof that the structure also lands correctly on reality.

- **S1 · Poverty-trap persistence** — with no policy, income decays to subsistence. *Barlas 1996; Sargent 2013. Pass.*
- **S2 · Integration dominates single-stance** — the integrated strategy beats market-only and welfare-only; the whole exceeds the parts. *Barlas 1996; Sargent 2013. Pass.*
- **S3 · Connective-failure case responds to market linkage** — the low-extraction craft responds to market-access policy. *Sargent 2013. Pass.*
- **S4 · Distributional-failure case responds to structural policy** — the high-extraction craft responds to the structural/integrated bundle. *Sargent 2013. Pass.*
- **S5 · Archetype divergence** — the two archetypes respond differently: distinct structural diagnoses, distinct levers. *Barlas 1996; Sargent 2013. Pass.*
- **C3 · Leave-one-out portfolio structure** — removing each policy in turn reveals a load-bearing core whose removal breaks escape, redundant members whose removal costs nothing, and no member whose removal improves the outcome. Prune for parsimony, not for gain. *Saltelli 2004; Sargent 2013. Pass.*

What a pass means, and does not

A pass means the structure is internally sound, behaves sensibly across regimes, and reproduces the documented qualitative pattern of the sector. It does **not** mean the model predicts income levels for

a real cluster. Effect sizes are illustrative; the validated object is the reasoning, not the rupee figure. This is stated so the suite is read for what it is.

References

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