L1: Five Invariants Changes Proposal

Proposed Amendments to the Risk Ontology Stack (Artifact 2, S4.1) -- February 2026

After cross-referencing the five morphological invariants against resilience science, network theory, and financial risk literature, three invariants require refinement. Each change below follows the same pattern: the formal definition has a gap that the applied examples and academic literature already fill. The proposed changes make implicit knowledge explicit -- no new invariants are added, no downstream logic (L0, L2, L3, L4) is disrupted, and all five remain domain-universal.

1 The Three Changes

A. Redundancy: Independence vs. Diversity

The definition requires "multiple independent structures." The examples (forest, token, human) all require diverse responses to the same perturbation -- not just independent pathways. 10 identical servers are independent but collapse under the same failure mode. Independence from each other is not independence from the same P.

CURRENT (Artifact 2, S4.1)

"...distributed across multiple INDEPENDENT structures, pathways, or mechanisms."

Counts pathways. No relation to P.

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PROPOSED

"...distributed across multiple structures, pathways, or mechanisms WITH DIVERSE PERTURBATION-RESPONSE PROFILES."

Counts pathways that fail differently under the same P.

Basis: Elmqvist et al. (2003) Response Diversity; Stirling (2007) Variety-Balance-Disparity; Biggs et al. (2020) Functional Redundancy. Jeremy's own examples already require this reading.

B. Connectivity Density: Propagation without Compartmentalization

The definition captures how perturbation propagates (diffusion vs. channeling) but not whether it stays contained within subsystems. A modular topology localizes failure even under dense coupling -- this is why two equally-connected systems can have opposite risk profiles. The definition already says "the same density can produce opposite effects" but never names the geometric property that explains why: modularity.

CURRENT (Artifact 2, S4.1)

"The richness and distribution of couplings within the system."

Covers propagation geometry. Silent on compartmentalization.

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PROPOSED

"The richness, distribution, and COMPARTMENTALIZATION of couplings within the system."

Adds modularity: whether deformation stays local or goes global.

Basis: Simon (1962) Nearly Decomposable Systems; Newman (2006) Modularity and Community Structure; May (1972) ecosystem stability; Haldane & May (2011) systemic financial risk.

C. Feedback Latency: Delay without Gain

The definition captures when the system responds (temporal depth) but not what the response does once engaged. It mentions "amplifying" in passing but treats it as a parenthetical edge case. A fast positive feedback loop is more dangerous than a slow negative one -- latency alone is half the picture. Feedback polarity (restoring vs. amplifying) determines whether response dynamics heal or accelerate deformation.

CURRENT (Artifact 2, S4.1)

"Time delay between perturbation and response dynamics engaging." Geometric role: "temporal depth of deformation."

Mentions "amplifying" once. Gain is not structural.

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PROPOSED

"Time delay and GAIN POLARITY of response dynamics. Latency = when R engages. Gain = whether R restores or amplifies."

Both delay and polarity determine deformation trajectory.

Basis: Meadows (2008) Leverage Points; Scheffer (2009) Critical Transitions; Sornette (2003) positive feedback cascades; Brunnermeier & Pedersen (2009) margin/liquidity spirals.

2 Before & After: All Five Invariants

(1) Redundancy

REFINED

Before: "...distributed across multiple independent structures, pathways, or mechanisms."

Geometric role: Buffer against fragmentation.

After: "...distributed across multiple structures with diverse perturbation-response profiles."

Geometric role: Buffer against fragmentation + perturbation-specificity.

(2) Connectivity Density

REFINED

Before: "The richness and distribution of couplings within the system."

Geometric role: Propagation geometry (diffusion vs. channeling).

After: "The richness, distribution, and compartmentalization of couplings."

Geometric role: Propagation geometry + whether deformation stays local or propagates globally.

(3) Feedback Latency

REFINED

Before: "Time delay between perturbation and response dynamics engaging."

Geometric role: Temporal depth of deformation.

After: "Time delay and gain polarity of response dynamics."

Geometric role: Temporal depth + whether response restores or amplifies deformation.

(4) Regeneration Rate

UNCHANGED

Rate of manifold restoration after contraction. Determines reversibility. High = temporary contraction. Low = irreversible narrowing. No gap identified.

(5) Dependency Concentration

UNCHANGED

Degree to which manifold geometry relies on a small number of nodes. Determines criticality profile. Precondition for cascading collapse. No gap identified.

3 Downstream Impact

L0 (Risk = manifold contraction): Unchanged. All three refinements stay within the manifold geometry framework.

L2 (Derivation bridge): All invariant-to-triad mappings hold. The enrichments explain existing High/Med/Low contributions, they don't add new ones.

L3 (Capital Morphology): Coherence (from Connectivity) already includes modularity concepts. No L3 rename needed.

L4 (Subscore standards): Count-only metrics become insufficient for Redundancy and Connectivity. Feedback subscores need polarity, not just speed.

4 Universality Check

Domain	Redundancy change	Connectivity change	Feedback change
Forest	Species fill same niche but respond differently to fire	Mycorrhizal nets have modular clusters by tree species	Regrowth feedback can amplify (invasive species) or restore
Token network	Liquidity sources that react differently to same market shock	DEX pools isolated from CEX contagion = compartmentalized	Liquidation cascades = positive feedback; buybacks = negative
DAO	Diverse governance paths that survive same voter attack	Sub-DAOs as firewall modules for treasury risk	Rage-quit spirals = positive; stake-lock = negative feedback
Bridge / Infra	Validators with different hardware/software stacks	Isolated relay chains prevent cross-bridge contagion	Slashing = negative feedback; bank run on bridge = positive
Virus / Bio	Immune pathways targeting different viral mechanisms	Tissue compartments limit systemic infection spread	Cytokine storm = positive; antibody response = negative

Sources

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