

Norms and Enforcement

Systems Thinking · Module 8 — Institutional Systems

Node 8.2

Position in Knowledge Graph

This node formalizes norms as equilibrium constraints sustained by enforcement mechanisms.

It builds on: - Institutions as Constraint Systems (8.1)

It prepares for: - Path Dependence (8.3) - Principal-Agent Theory (9.2)

Norms are endogenous behavioral regularities stabilized by incentives and sanctions.

Formal Statement / Definition / Construction

Let there be n agents with action spaces $\mathcal{A}_i$.

Let joint action:

$$a = (a_1, \dots, a_n) \in \mathcal{A}.$$

Each agent has utility:

$$U_i(a) : \mathcal{A} \rightarrow \mathbb{R}.$$

Definition (Norm)

A **norm** is a strategy profile $a^* \in \mathcal{A}$ such that:

1. a^* is self-enforcing under institutional constraints,
2. Deviation triggers sanction reducing utility.

Formally, suppose deviation by agent i leads to punishment action P_i .

Norm condition:

$$U_i(a^*) \geq U_i(a'_i, a_{-i}^*) - S_i(a'_i),$$

for all $a'_i \in \mathcal{A}_i$,

where:

$$S_i(a'_i) \geq 0$$

is sanction imposed after deviation.

Enforcement Mechanism

Define enforcement mapping:

$$E : \mathcal{A} \rightarrow \mathbb{R}^n,$$

where $E_i(a) = S_i(a_i)$ if deviation detected.

Effective utility:

$$\tilde{U}_i(a) = U_i(a) - E_i(a).$$

Norm requires:

$$a^* \text{ is Nash equilibrium under } \tilde{U}.$$

Assumptions and Conditions

1. Agents are rational (maximize utility).
2. Sanctions are credible.
3. Deviations are observable.
4. Enforcement mapping well-defined.

No assumption of central authority; enforcement may be decentralized.

Proof or Mathematical Development

Self-Enforcement Condition

Without sanction:

$$U_i(a'_i, a^*_{-i}) > U_i(a^*)$$

implies deviation profitable.

With sanction:

$$\tilde{U}_i(a'_i, a^*_{-i}) = U_i(a'_i, a^*_{-i}) - S_i(a'_i).$$

Norm stable if:

$$S_i(a'_i) \geq U_i(a'_i, a^*_{-i}) - U_i(a^*).$$

Thus minimal sanction equals gain from deviation.

Repeated Interaction

In repeated setting with discount factor $\delta \in (0, 1)$,
present value of deviation:

$$U_i^{\text{dev}} = U_i(a'_i, a_{-i}^*) + \delta V_i^{\text{punishment}}.$$

Norm sustainable if:

$$U_i(a^*) + \delta V_i^{\text{continuation}} \geq U_i^{\text{dev}}.$$

Higher δ increases enforceability.

Structural Role

Norms:

- Convert constraints into stable equilibria.
- Operate through incentive-compatible enforcement.
- Link institutional rules to behavioral regularities.
- Depend on observability and sanction credibility.

They are decentralized stabilization mechanisms.

Structural Compression

Invariant

Norm stable if:

$$U_i(a^*) \geq U_i(a'_i, a_{-i}^*) - S_i(a'_i).$$

Mechanism

Sanction offsets deviation gain.

Cross-System Echo

- Control Theory: penalty functions.
 - Economics: repeated-game equilibria.
 - Biology: social punishment in populations.
 - Networks: protocol enforcement mechanisms.
-

Systems Thinking · Module 8 — Institutional Systems · Node 8.2

Concepts: institutions, nash-equilibrium, governance

Prerequisites: 8.1

Enables: 8.3, 9.2

hbar.university — own.your.cognition