Foundations of a Post-Currency Socioeconomic System

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A Scalable, Polycentric, and Failure-Resilient Framework

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This is the rigorous version with full mathematical formulation. For a narrative treatment of what this system feels like to live in, see the narrative version.

How to read this paper

This document presents a formal systems framework: its equations specify proposed relationships, constraints and design objectives. They are not, by themselves, proofs of large-scale stability. Several functions are named without being fully specified, and the step from small egalitarian societies to large, technologically connected populations is a hypothesis to be tested, not a demonstrated result. The framework identifies hypotheses to be tested through simulation, pilot implementation and external review. For a reproducible quantitative comparison of coordination with and without money, see Is Money Necessary?

Abstract

This paper presents a formal and empirically grounded framework for a post-currency socioeconomic system in which allocation is governed by need-based signaling, feedback-controlled production, and distributed coordination. Drawing on anthropological evidence from egalitarian societies (e.g., San, Mbendjele, Agta), cybernetic systems theory, commons governance research, and distributed systems architecture, we demonstrate that non-price coordination is not only historically grounded but structurally definable.

We extend these insights by introducing a scalable architecture based on polycentric modular systems coordinated through a shared digital infrastructure — the New World Web (NWW) — which enables real-time visibility of demand, supply, and constraints. We further integrate a failure-resilient design incorporating detection, containment, and recovery mechanisms derived from control theory, supply-chain dynamics, and high-reliability organizational research.

The resulting framework establishes that post-currency systems are not merely theoretically plausible but represent a class of systems that are empirically anchored, structurally coherent, and potentially scalable under specific architectural conditions.

1. Introduction

Modern economic systems rely on price-mediated coordination, yet exhibit persistent inefficiencies including inequality, resource misallocation, and cyclical instability (Piketty, 2014; Stiglitz, 2012). These outcomes raise a fundamental question:

> Is price-based coordination necessary for large-scale socioeconomic organization?

Anthropological evidence suggests otherwise. Numerous egalitarian societies have historically operated without currency, relying instead on sharing norms, direct allocation, and social enforcement mechanisms (Woodburn, 1982; Boehm, 1999; Kelly, 2013).

This paper develops a formal model of such systems, extending them through modern technological capabilities to evaluate their scalability, coordination capacity, and resilience.

2. System Definition

A post-currency system is defined by the following properties:

- Allocation is not mediated by exchange units
- Access is based on need, usage, and constraints
- Production responds dynamically to demand signals
- Coordination is achieved through distributed information systems

3. Mathematical Framework

Let agents $i \in N$ and resources $j \in R$.

3.1 Demand Function

$$\text{Need}_{i,j}(t) = f\big(\text{Request}_{i,j}(t),\ \text{Usage}_{i,j}(t),\ \text{Forecast}_j(t)\big)$$

This formulation integrates:

- Expressed demand
- Revealed consumption patterns
- Predictive modeling

3.2 Production Dynamics

$$\text{Production}_j(t+1) = \text{Production}_j(t) + \alpha\big(\sum_i \text{Need}_{i,j}(t) - \text{Supply}_j(t)\big)$$

This corresponds to a proportional feedback control system (Wiener, 1948; Sterman, 2000).

3.3 Allocation Constraint

$$\sum_i \text{Consumption}_{i,j}(t) \leq Q_j(t) \quad \text{for every good } j \text{ and time } t$$

Where $Q_j(t)$ is the total quantity of good j available at time t, adjusted over time to maintain system stability.

3.4 Stability Condition

$$\lim_{t \to \infty} |\text{Demand}_j(t) - \text{Supply}_j(t)| = 0$$

This is a design objective, not a derived result. Whether the feedback rule in 3.2 reaches it depends on the gain α and on delays in production and information: in feedback systems with delays, too strong a correction produces oscillation rather than balance (Sterman, 2000). The conditions under which it holds are to be established by simulation and pilot data.

4. Behavioral and Social Dynamics

Human behavior in the system is governed by reinforcement dynamics:

$$P(B_k) \propto \text{Reward}(B_k)$$

(Skinner, 1953)

4.1 Anti-Accumulation Constraint

$$A_i(t) \leq A_{\max} \quad \text{for all } t \geq t_0$$

A standing constraint on every participant's accumulated control over shared resources from the time the framework is adopted, rather than a limit reached only eventually.

4.2 Dominance Suppression

$$\frac{dD_i}{dt} = f(A_i) - \omega C(D_i)$$

Where ω is the dominance suppression coefficient and $C(D_i)$ represents corrective mechanisms (Boehm, 1999).

4.3 Empathy Feedback

$$E_i = \frac{E_0}{1 + k \ln(W_i + 1)}$$

Higher power reduces empathic response (Keltner et al., 2003).

5. Empirical Foundations

Anthropological evidence demonstrates that systems with post-currency properties have existed at scale and persisted over long time periods. Key societies include the San (Southern Africa), Mbendjele (Congo Basin), and Agta (Philippines) (Woodburn, 1982; Kelly, 2013; Lewis, 2014).

These systems exhibit:

- Allocation without pricing
- Distributed access to resources
- Social enforcement of sharing norms
- Active suppression of accumulation and dominance
- Immediate-return provisioning dynamics

Each component of the formal model maps to an observed mechanism in these societies:

- **Demand signaling:** In San-type systems, demand is expressed directly and consumption patterns are socially visible. The formal model replaces social visibility with data visibility and cultural memory with predictive modeling.
- **Production coordination:** Foraging and hunting adjust to need and availability with minimal surplus. The formal model is a cybernetic scaling of these immediate-return provisioning dynamics.
- **Distribution:** San-type systems distribute through social networks without a pricing layer. Modern infrastructure enables scaling of direct distribution without price mediation.
- **Allocation constraints:** Egalitarian societies use informal norms to regulate excess consumption. The formal model replaces informal norms with explicit constraint systems.

> This model is not without precedent. It represents a technologically mediated extension of egalitarian, non-accumulative human systems observed over long time scales.

6. Incentive and Participation Model

The system does not rely on monetary incentives. Participation emerges from structural conditions rather than extrinsic reward:

- **Reduced labor burden:** automation and elimination of artificial demand reduce total required labor

- **Direct effort-outcome linkage:** work directly sustains visible, shared outcomes rather than generating abstract exchange units
- **Autonomy:** task selection is voluntary, based on skill, interest, and system need
- **Social recognition:** contribution is visible and valued within the community

San and similar groups demonstrate high participation without monetary reward, with motivation driven by social cohesion, reciprocity, and shared survival (Woodburn, 1982; Boehm, 1999).

6.1 Production Characteristics

$$\text{Production} \approx \text{Need} + \text{Buffer}$$

In immediate-return systems, production closely tracks need with minimal overproduction. The formal model eliminates artificial demand generation (advertising, planned obsolescence) that characterizes price-mediated systems.

7. Scalability Architecture

Scaling is achieved through polycentric modular structure (Ostrom, 1990; Ostrom, 2010).

7.1 Structure

- **Local nodes:** high-trust environments
- **Regional layers:** resource balancing
- **Network layer:** inter-node coordination

7.2 Node Dynamics

$$\text{State}_n(t) = f(\text{Local Demand},\ \text{Local Supply},\ \text{Constraints})$$

7.3 Inter-Node Coupling

$$\text{Flow}_{n \to m}(t) = g(\text{Surplus}_n,\ \text{Deficit}_m)$$

7.4 Stability Condition

$$\sum_n \text{Supply}_n \approx \sum_n \text{Demand}_n$$

7.5 Key Property

Scalability emerges from federation of semi-autonomous units rather than centralization.

8. Coordination Layer: New World Web

The NWW functions as a shared information substrate:

8.1 Global Information Function

$$I(t) = \{\text{Demand}_j(t),\ \text{Supply}_j(t),\ \text{Constraints}_j(t)\}$$

8.2 Optimization Objective

$$\text{Minimize:} \quad \sum_j |\text{Demand}_j - \text{Supply}_j|$$

8.3 Effect on Scaling

The NWW reduces:

- Information asymmetry
- Coordination delay
- Signal distortion

This parallels digital commons systems (Benkler, 2006) and open-source coordination models.

9. Failure Modes and Resilience Architecture

System stability depends on continuous detection, containment, and correction. All failures follow a five-phase recovery protocol aligned with high-reliability organization principles (Weick & Sutcliffe, 2007):

1. Detection
2. Stabilization
3. Containment
4. Correction
5. Structural redesign

9.1 Demand Distortion

Signal manipulation or misinterpretation creates mismatch between data-driven signals and actual need (Lee et al., 1997).

- **Prevention:** multi-signal validation, anomaly detection, rate limiting
- **Detection:** request-vs-usage mismatch, volatility spikes
- **Containment:** freeze auto-scaling, shift to conservative allocation
- **Recovery:** recalibrate forecasting, reintroduce adaptive scaling

9.2 Supply Instability

Coordination breakdown or dependency failure disrupts production chains.

- **Prevention:** redundancy, dependency mapping
- **Detection:** fulfillment drop, inventory instability
- **Containment:** isolate bottleneck, activate substitutes
- **Recovery:** rebalance production, stabilize buffers

9.3 Accumulation Re-Emergence

Resource hoarding pathways reintroduce concentration dynamics.

- **Prevention:** transparency, allocation tracking, role rotation
- **Detection:** concentration anomalies in access patterns
- **Containment:** restrict access pathways
- **Recovery:** redistribute excess, redesign allocation rules

9.4 Governance Capture

Centralization of authority undermines distributed decision-making.

- **Prevention:** polycentric governance, rotation, auditability
- **Detection:** authority concentration, declining appeal success rates
- **Containment:** suspend concentrated authority
- **Recovery:** redistribute decision power

9.5 NWW Data Layer Failure

Corruption, outage, or manipulation of the coordination substrate.

- **Prevention:** redundancy, distributed validation
- **Detection:** data inconsistencies across nodes
- **Containment:** downgrade to local-mode operation
- **Recovery:** reconcile system state, restore coordination layer

9.6 Participation Decline

Disengagement or labor imbalance reduces system capacity.

- **Prevention:** task flexibility, automation of undesirable work
- **Detection:** backlog growth, unfilled task queues
- **Containment:** reprioritize critical tasks
- **Recovery:** rebalance workload distribution

9.7 Infrastructure Fragility

Technical system failure undermines coordination capacity.

- **Prevention:** decentralization, redundancy
- **Containment:** isolate failure, maintain local operation
- **Recovery:** restore via backup systems

9.8 External Pressure

Interaction with currency-based systems introduces destabilizing forces.

- **Prevention:** controlled interfaces, export constraints
- **Containment:** restrict outflows, buffer internal system
- **Recovery:** rebalance internal allocation

9.9 Control Mechanism

All subsystems operate as closed-loop control:

$$\text{State}(t+1) = \text{State}(t) - \gamma \cdot \text{Error}(t)$$

> The critical distinction from San-type systems: reliance on technological mediation. The system substitutes digital transparency for social transparency, creating both new capabilities and new vulnerability surfaces.

10. Interface with Currency-Based Systems

During transition and ongoing coexistence, the post-currency system requires explicit mechanisms for interacting with external currency-based systems. The interface framework includes three exchange modalities:

10.1 Quantity-Based Exchange

Direct exchange of goods based on physical quantities rather than monetary valuation. Applicable where both systems produce comparable physical goods.

10.2 Reference-Based Valuation

When currency-based systems require monetary pricing, the post-currency system uses external reference prices for interface purposes only, without internalizing price-based allocation.

10.3 Multi-Variable Exchange

Complex exchanges evaluated across multiple dimensions (resource cost, labor intensity, environmental impact) rather than reduced to a single monetary value.

10.4 Export Constraints

Internal resources are protected from extraction by external systems through export limits calibrated to maintain internal sufficiency.

10.5 Mixed-System Enterprises

Entities operating across both systems maintain separate accounting — currency-based externally, need-based internally — with firewalls preventing currency logic from penetrating internal allocation.

> The external interface represents the boundary between a high-accumulation, low-redistribution regime (currency-based) and a low-accumulation, high-redistribution regime (post-currency). Managing this boundary is critical for preventing reintroduction of accumulation pathways.

11. Open Questions

- **Scalability of anti-accumulation mechanisms:** Can social enforcement mechanisms scale through technological mediation without losing effectiveness?
- **Data systems vs. social enforcement:** How robust are data-driven constraint systems compared to the socially-enforced norms they replace?
- **Hybrid-system dynamics:** What are the stability conditions for long-term coexistence of post-currency and currency-based systems?
- **Transition thresholds:** At what parameter values does a system cross from one attractor basin to another, and is this transition reversible?
- **Psychological adaptation:** What is the timeline for behavioral adaptation from scarcity-driven to abundance-oriented participation patterns?

12. Conclusion

This framework shows that:

- Non-price coordination systems exist in human history and their dynamics are understood at small scale
- Modern technology enables potential scaling through polycentric architecture and shared coordination infrastructure
- The system is stabilized through embedded failure detection, containment, and recovery mechanisms
- Interface with existing currency-based systems is structurally definable

> This model has shifted from "theoretically plausible" to "empirically anchored but not yet scaled." Its core mechanisms are grounded in observed human systems; its limitations are clearly identified; and its architecture addresses the central challenge of maintaining egalitarian dynamics at scale.

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