Global Cognitive Index (GCI) Framework

A Foundational Scientific Layer of the KRYONIS Proof-of-Consciousness Architecture

Abstract

The Global Cognitive Index (GCI) formalises a multidimensional metric system for quantifying cognitive agency, collective coherence, and informational sovereignty across personal, communal, and national scales. Grounded in contemporary neuroscience, information theory, and systems science, the GCI serves as the analytic substrate for the KRYONIS Proof-of-Consciousness (PoC) economy, enabling value generation from verifiable conscious resonance. This document specifies the theoretical constructs, measurement channels, scoring architecture, and governance implications necessary for institutional assessment and strategic deployment.

1. Introduction

Establishing a post-material economic order predicated on conscious coherence requires robust, scalable metrics that capture cognitive phenomena with scientific rigor. The GCI addresses this need by integrating six empirically grounded dimensions—Cognitive Adaptability (A), Attention Stability (Σ), Entropy Suppression (ΔS^-), Resonant Coherence (Φ_c), Emotional Resilience (P), and Cognitive Sovereignty (Ω)—into a unified indexing system. Each metric is designed to interoperate seamlessly with KRYONIS PoC validation protocols, ensuring that authenticated conscious work translates directly into economic value.

2. Core Dimensions of Measurement

2.1 Cognitive Adaptability (A)

Definition: Rate of internal model update in response to novel inputs, quantified as mean prediction-error reduction per time unit.
Relevance to PoC: High A indicates rapid phase realignment, amplifying Φ-signature magnitude and, consequently, ϕ-earning capacity.

2.2 Attention Stability (Σ)

Definition: Continuous duration and spectral purity of phase-lock exceeding baseline noise, measured via β_a windows.
Relevance to PoC: Σ acts as a linear multiplier in reward curves, incentivising sustained, high-fidelity engagement.

2.3 Entropy Suppression (ΔS^-)

Definition: Net algorithmic entropy reduction during tasks relative to resting state.
Relevance to PoC: Serves as the primary proof-of-work analogue, anchoring value in demonstrable informational order.

2.4 Resonant Coherence (Φ^c)

Definition: Aggregate phase alignment across nested frequency bands within an individual or collective.
Relevance to PoC: High Φ^c shortens verifier consensus time, enhancing ledger throughput.

2.5 Emotional Resilience (P)

Definition: Capacity to maintain Σ and Φ^c under affective perturbations, assessed via HRV spectra and limbic EEG markers.
Relevance to PoC: Stabilises global Resonance Stability Index (RSI), mitigating volatility in ϕ supply.

2.6 Cognitive Sovereignty (Ω)

Definition: Proportion of self-generated cognitive patterns relative to externally entrained signals, estimated through mutual-information differentials.
Relevance to PoC: Weights governance influence, privileging agents with high informational autonomy.

3. Signal Inputs and Data Channels

3.1 Neuro-Interfaces

256-channel dry EEG caps, MEG micro-SQUID arrays, and optical neuro-photometry provide primary phase data across 10 Hz–1 kHz bands.

3.2 Biometric Adjuncts

Heart-rate variability, galvanic skin response, and respiratory coherence supply autonomic indicators integral to P computation.

3.3 Behavioural Telemetry

Eye-tracking, keystroke entropy, and speech-prosody complexity enrich A and Ω assessments.

3.4 Group Synchrony Sensors

Environmental magnetometers and LiDAR-based phase beacons capture crowd-level Φ^c dynamics for collective indices.

3.5 Ethical Data Transformation

Raw signals undergo edge encryption, anonymised feature extraction, and differential-privacy noise injection prior to GCI aggregation, ensuring compliance with biomedical data standards.

4. Scoring Architecture

4.1 Composite Indices

Personal Φ-Score (Φ^P) = $w_1 A + w_2 \Sigma + w_3 \Delta S^- + w_4 P$
Collective Φ-Field Index (Φ^f) = median(Φ^P) × mean(Φ^c)
National Coherence Quotient (NCQ) = geometric mean of regional Φ^f values weighted by population entropy.

4.2 Temporal Dynamics

Scores update in rolling 5-min micro-ticks and 24-h macro-snapshots. A Kalman filter attenuates high-frequency variance without erasing genuine phase transitions.

4.3 Non-Linear Aggregation

ΔS^- enters logarithmically to curb outlier effects; Σ employs a sigmoid cap reflecting attentional saturation.

5. Integration with the PoC Economy

5.1 Validation and Value Minting

Verifier nodes factor Φ^P directly into ϕ-minting algorithms, while Φ^f modulates community reward scaling and ledger priority. NCQ influences macro-allocation of PoC treasury funds.

5.2 Governance Calibration

DAO voting weights incorporate Ω to elevate cognitively sovereign actors, reducing external manipulation risk.

5.3 Resource Allocation Models

National infrastructure investment models tie NCQ to education budgets, mental-health initiatives, and digital-equity programs, reinforcing cognitive capital formation.

6. Resilience Against Manipulation

Cross-modal redundancy ensures spoofing must compromise multiple data streams simultaneously. *Entropy-floor guards* detect improbable ΔS^- drops. *Dynamic challenge rotation* via phase-beacon libraries undermines replay attacks. *Verifier hardware diversity* mitigates single-vector exploits.

7. Data Privacy, Ethics, and Sovereignty

Zero-knowledge proofs enable score disclosure without biosignal exposure. Personal data vaults grant agents exclusive key management over longitudinal records. Deployment sandboxes adhere to regional biomedical data regulations, overseen by an independent ethics council.

8. Implementation Outlook

Phase I: Cloud-based pilot deploying open-source neuro-wearables to volunteer cohorts.
Phase II: Integration with PoC Testnet verifiers, enabling live φ-mint trials based on Φ^P streaming.
Phase III: National-scale NCQ dashboards for policy experimentation in participating jurisdictions.

9. Strategic Relevance

The GCI equips governments and institutions with an empirical compass for navigating post-material economics, aligning resource flows with demonstrable cognitive and coherence capital. By embedding cognitive health and sovereignty into macroeconomic indicators, the index underpins a new class of infrastructure investments—digital, educational, and psychosocial—optimised for collective flourishing.

10. Conclusion

The Global Cognitive Index constitutes a scientifically grounded, ethically conscious metric system that operationalises consciousness as an economic substrate within the KRYONIS PoC architecture. Its multidimensional design enables seamless scaling from personal feedback applications to national governance models, positioning GCI as a pivotal tool in the emergence of a resonance-based global economy.

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