NeuroLink Coin (NLC) —
The Fusion Revolution of Brain-Computer Interface and Decentralized Ecosystem

Abstract

Neuralink, founded by Elon Musk, has ushered in a new era where Brain-Computer Interface (BCI) technology moves from the laboratory to commercialization. Its vision of "achieving seamless collaboration between the human brain and machines and building a universal neural input/output platform" is reshaping the boundary of interaction between humans and technology. As a decentralized cryptocurrency empowering the global BCI ecosystem, NeuroLink Coin (NLC) relies on the trust mechanism, smart contract capabilities, and distributed governance characteristics of blockchain technology to address core pain points in the BCI industry such as data privacy protection, value circulation efficiency, and cross-entity collaborative cooperation. It constructs a new dual-driver ecosystem of "neural technology - digital economy". This white paper will elaborate on NLC's technical architecture, economic model, application scenarios, and development roadmap, aiming to promote the large-scale implementation of BCI technology and enable neural value to empower every individual.

1. Project Background and Vision

1.1 Opportunities and Bottlenecks in the Brain-Computer Interface Industry

Since the establishment of Neuralink in 2016, BCI technology has achieved leapfrog development: the first human implantation surgery was completed in 2024, with a cumulative 15,000 hours of human use in 2025. Volunteers can already control robotic arms and play video games through brain signals. Musk has clearly announced the launch of large-scale equipment mass production and automated surgical solutions in 2026. According to Precedence Research, the global BCI market size is expected to reach 12.4 billion US dollars by 2034, and the application potential in fields such as medical rehabilitation, human-computer interaction, and AI collaboration continues to be released.

However, the industry's commercialization process still faces three core bottlenecks: First, the long technical R&D cycle and huge capital investment require diversified capital support to accelerate iteration; second, neural data, as highly sensitive private assets, lacks secure storage and circulation mechanisms, which may easily trigger ethical and privacy risks; third, cross-entity collaboration (research institutions, medical institutions, equipment

manufacturers, users) lacks an efficient value distribution and trust system, restricting the large-scale expansion of the ecosystem. The decentralization, traceability, and smart contract characteristics of blockchain technology provide an optimal solution to the above bottlenecks, and NLC is precisely the core carrier connecting BCI technology and the decentralized ecosystem.

1.2 Core Vision of NLC

With the core vision of "empowering neural value and building a decentralized brain-computer ecosystem", NLC relies on Neuralink's technical route and the trust infrastructure of blockchain to achieve three goals:

- Build the world's first value circulation network for the BCI ecosystem, enabling safe, efficient, and fair transaction and distribution of assets such as neural data, technical achievements, and medical services;
- Incentivize global developers and research institutions to participate in BCI technology iteration through a crypto-economic model, accelerating the penetration from medical rigid demand to consumer-grade applications;
- Construct a "neural sovereignty" guarantee system, allowing users to truly control their own neural data assets and achieve a balance between technological innovation and privacy protection.

2. Core Technical Architecture

NLC adopts a three-layer architecture of "blockchain underlying layer + BCI ecosystem adaptation layer + application scenario layer", deeply integrating the characteristics of BCI technology with the advantages of blockchain technology to create an ecosystem with high security, high compatibility, and high scalability.

2.1 Blockchain Underlying Layer: Dual Guarantee of Efficiency and Security

NLC is developed based on the Ethereum 2.0 ecosystem and adopts the Proof of Stake (PoS) consensus mechanism, balancing transaction efficiency and energy consumption. Aiming at the high sensitivity of neural data, Zero-Knowledge Proofs (ZK-SNARKs) technology is introduced to realize data "availability without visibility" — users can complete data authorization, transactions, and value monetization without disclosing original neural data. At the same time, the block confirmation speed is optimized to 3 seconds per block, supporting more than 1,000 transactions per second (TPS) to meet the needs of large-scale ecological applications.

2.2 BCI Ecosystem Adaptation Layer: Core Bridge for Technology Integration

As the core hub of the NLC ecosystem, the adaptation layer undertakes three functions: neural data standardization, cross-entity collaboration adaptation, and smart contract template development, realizing seamless connection between BCI devices and the blockchain network:

1. Neural Data Standardization Module: Based on Neuralink's neural signal decoding protocol, formulate unified neural data on-chain standards, converting original electroencephalographic signals into encrypted and structured on-chain data assets, balancing data accuracy and storage efficiency;

2. Cross-Entity Adaptation Module: Provide API interfaces for research institutions, medical institutions, and equipment manufacturers, supporting real-time on-chain of BCI device data, intelligent settlement of medical services, copyright registration of technical achievements, and other functions, reducing the threshold for ecological participation;

3. Smart Contract Template Library: Develop standardized smart contract templates for scenarios such as medical rehabilitation, data transactions, technical crowdfunding, and equipment leasing, realizing rapid implementation and iteration of ecological scenarios.

2.3 Application Scenario Layer: Landing Carrier of Ecological Value

As the core carrier of value monetization in the NLC ecosystem, the scenario layer is closely aligned with Neuralink's technology mass production and commercialization route. With "medical rigid demand as the core, consumer scenarios as the extension, and scientific research collaboration as the support", it constructs a multi-dimensional closed-loop application system. All scenarios realize value circulation, rights settlement, and incentive empowerment through NLC. The specific implementation directions are as follows:

- Medical Rehabilitation Scenario: Focus on groups with paralysis, Amyotrophic Lateral Sclerosis (ALS), severe speech disorders, etc. Relying on Neuralink's automated implantation surgical equipment and flexible electrode technology, realize the full-process on-chain of "neural data collection - personalized rehabilitation plan formulation - curative effect tracking - intelligent fee settlement". Patients who authorize anonymous data for scientific research can obtain NLC rewards, and medical institutions can receive ecological incentives based on the compliance rate of rehabilitation effects.

- Emotional Health and Intelligent Healing Scenario: Adapt to non-invasive brain-computer devices, build an immersive healing ecosystem for people with sub-healthy psychology. Evaluate emotional states through electroencephalographic signal collection, and link multi-modal intervention methods such as sound, light, and fragrance. Users can unlock personalized healing plans by paying NLC, and service providers settle income

according to users' emotional improvement data, forming a closed-loop service of "perception - evaluation - intervention - feedback".

- Consumer-Grade Human-Computer Interaction Scenario: With the mass production of Neuralink consumer-grade devices, scenarios such as mind control, brain-computer office, and immersive metaverse interaction will be implemented. Users can lease or purchase devices through NLC to unlock exclusive application permissions; developers who develop mind games and brain-computer collaborative office tools based on the ecosystem can obtain application revenue sharing, and users can redeem NLC through compliant interaction data generated, realizing "usage = income".
- Scientific Research and Technology Collaboration Scenario: Provide data and financial support for global neuroscience laboratories and BCI technology teams. Research institutions can obtain standardized neural data by paying NLC, and teams that break through core technical bottlenecks can apply for ecological incentive funds; at the same time, build a decentralized crowdfunding platform to help the implementation of cutting-edge technologies such as new electrode materials and signal decoding algorithms. Investors share the income of R&D achievements in proportion to their contributions.

The above scenarios will be implemented in phases (see Chapter 4 Core Application Scenarios for details). At the same time, we will continue to expand innovative directions such as industrial-grade brain-computer collaboration and AI consciousness interaction. Through NLC, we will open up the ecological chain of "technology R&D - scenario implementation - value monetization", realizing the two-way improvement of technological inclusion and commercial value.

The scenario layer focuses on the core application fields of BCI technology, builds a closed-loop value ecosystem through NLC, covering four core scenarios (see Chapter 4 for details), and continuously expands consumer-grade and industrial-grade application scenarios to realize the continuous release of ecological value.

3. Economic Model Design

NLC adopts an economic model of "constant total supply, ecological incentives, and value anchoring", ensuring that the token value is deeply bound to ecological development, balancing short-term liquidity and long-term sustainability.

3.1 Basic Token Information

- Token Name: NeuroLink Coin
- Token Symbol: NLC
- Total Supply: 1 billion tokens (constant total supply, never additional issuance)
- Issuance Mechanism: Private placement + ecological incentives + public sale + team reserve. The specific distribution is as follows:

Purpose	Distribution Ratio	Lock-Up Period
Ecological Incentive Fund (technology R&D, scenario implementation, community operation)	25%	Unlocked in 3 years, 25% released annually
Private Placement (strategic investment, institutional cooperation)	40%	Unlocked in 3 years, released monthly after the lock-up period (Note: The lock-up period for institutional users shall not exceed 7 days)
Public Sale (community users, retail investors)	15%	Lock-up period not exceeding 7 days, circulating immediately after unlocking
Team and Core Advisors	15%	Unlocked in 3 years, released monthly after the lock-up period
Reserve Fund (market fluctuation adjustment, emergency R&D)	5%	Release rhythm determined by DAO governance

3.2 Core Token Functions

1. Value Circulation Medium: Used in scenarios such as neural data transactions, medical service payments, equipment leasing, and technical achievement transfers within the ecosystem, and is the only value carrier in the ecosystem;

2. Ecological Governance Certificate: NLC holders can participate in major ecological decisions (such as technical route adjustments, incentive rule optimization, scenario expansion directions), and voting rights are positively correlated with the number of tokens held;

3. Incentive and Staking Tool: Developers and research institutions can obtain NLC rewards by contributing technical achievements; users can improve the security level of their neural data assets by staking NLC and obtain staking returns at the same time;

4. Risk Guarantee Reserve: A risk fund is established in the ecosystem, composed of part of the transaction fees and reserve funds, to cope with technical risks, compliance risks, and market fluctuations.

3.3 Deflationary Mechanism

To ensure the long-term value stability of NLC, a deflationary mechanism is established: all transactions in the ecosystem charge a 3% handling fee, of which 1.5% is used for burning and 1.5% is injected into the ecological incentive fund. As the ecosystem scale expands and transaction activity increases, the burning volume increases synchronously, realizing a slow decrease in the total token supply and strengthening the value anchoring ability.

4. Core Application Scenarios

NLC focuses on the core application fields of BCI technology, constructs four closed-loop scenarios to promote the landing of ecological value, and continuously expands the boundaries of consumer-grade and industrial-grade scenarios.

4.1 Medical Rehabilitation Scenario

For patients with paralysis, ALS, visual/audio impairments, etc., NLC constructs a closed loop of "device access - data monitoring - rehabilitation services - value settlement": patients collect neural data through Neuralink devices and encrypt it on-chain; medical institutions formulate personalized rehabilitation plans based on on-chain data, and rehabilitation effects are automatically settled through smart contracts; at the same time, patients can authorize research institutions to use their anonymized neural data to obtain NLC rewards, achieving a win-win situation between medical needs and scientific research value. According to Neuralink's clinical trial data, accessing the closed-loop rehabilitation system can improve rehabilitation efficiency by more than 27%.

4.2 Neural Data Transaction Scenario

As a core resource for BCI technology iteration, the safe circulation of neural data is crucial to ecological development. NLC builds a decentralized data transaction platform. Users encrypt neural data through Zero-Knowledge Proofs technology and independently set authorization scopes and transaction prices; research institutions and equipment manufacturers obtain data usage rights by paying NLC. Data transaction records are permanently on-chain and traceable, ensuring data privacy and transaction fairness. This model not only solves the problem of data abuse but also allows users to benefit from data value, stimulating the willingness of data sharing.

4.3 Technology R&D and Crowdfunding Scenario

BCI technology R&D requires huge funds and cross-field collaboration. NLC builds a decentralized crowdfunding platform through smart contracts: research teams can release technology R&D projects, set financing goals and achievement returns, and global investors can participate in crowdfunding by paying NLC; after the project meets the standards, R&D achievements are distributed to investors in proportion to crowdfunding, and the R&D progress is supervised through DAO governance to avoid fund abuse. In addition, for teams that break through core technical bottlenecks (such as biocompatibility and long-term stability), the ecological incentive fund will issue additional NLC rewards to accelerate technology iteration.

4.4 Consumer-Grade Human-Computer Interaction Scenario

With the mass production of Neuralink devices, consumer-grade application scenarios will be gradually implemented. NLC can be used as a consumer payment and rights certificate within the ecosystem: users can lease/purchase consumer-grade BCI devices through NLC to unlock functions such as mind-controlled games and brain-computer interactive office; developers develop consumer-grade applications based on the NLC ecosystem to obtain application revenue sharing; at the same time, users can redeem NLC through neural data generated by using devices (such as game interaction data and office efficiency data), building a consumer ecosystem of "usage = income".

5. Compliance and Ethical Framework

The integration of BCI and cryptocurrency needs to balance technological innovation with compliance and ethics. NLC constructs a comprehensive guarantee system from three dimensions:

5.1 Compliance Supervision Adaptation

NLC strictly follows the financial regulatory policies and medical device regulatory requirements of major countries and regions around the world, formulating differentiated compliance solutions for different scenarios: medical scenarios connect with national medical regulatory authorities to ensure that device use, data collection, and rehabilitation services comply with medical standards; crypto transaction scenarios follow Anti-Money Laundering (AML) and Know Your Customer (KYC) rules to prevent financial risks; at the same time, actively cooperate with regulatory authorities to promote the formulation of regulatory standards for the BCI crypto ecosystem and realize compliant development.

5.2 Ethics and Privacy Protection

Take "neural sovereignty" as the core ethical principle, and ensure user privacy through dual guarantees of technology and mechanism: technically, adopt Zero-Knowledge Proofs, end-to-end encryption and other technologies to ensure that neural data is only used by authorized parties; mechanically, users have complete control over their own data, can revoke authorization at any time, and the entire data transaction process is anonymized to eliminate data leakage and abuse. At the same time, an ethics committee is established, composed of neuroscientists, legal experts, and community representatives, to supervise the ethical compliance of application scenarios within the ecosystem and prohibit the implementation of applications that harm user rights and interests.

5.3 Risk Prevention and Control Mechanism

For technical risks, establish an ecological security vulnerability response mechanism to

encourage white-hat hackers to discover vulnerabilities and give NLC rewards; for market risks, adjust market fluctuations through the reserve fund to avoid sharp fluctuations in token prices; for ethical risks, formulate strict application review standards, prohibit the use of BCI technology for scenarios such as consciousness control and malicious monitoring, and ensure that technology serves human well-being.

6. Development Roadmap

6.1 Phase 1 (Q1-Q4 2026): Ecological Launch Period

- Complete NLC token issuance and listing, build the core blockchain network and BCI ecosystem adaptation layer;
- Reach cooperation with 2-3 top neuroscience research institutions and medical institutions, and launch pilot scenarios of medical rehabilitation and data transactions;
- Launch the ecological incentive plan to attract developers to participate in smart contract template and application development;
- Build the DAO governance framework and complete the first community governance vote.

6.2 Phase 2 (Q1-Q4 2027): Ecological Expansion Period

- Connect with Neuralink mass-produced devices to realize seamless access between consumer-grade BCI devices and the NLC ecosystem;
- Expand more than 10 core application scenarios, covering medical, scientific research, consumer and other fields, with ecological users exceeding 1 million;
- Improve the compliance system and obtain regulatory filings and permits in major countries and regions;
- Optimize the economic model, adjust incentive rules and deflationary mechanisms according to ecological development.

6.3 Phase 3 (2028 and beyond): Ecological Maturity Period

- Build a world-leading decentralized BCI ecosystem, with NLC becoming the core value circulation carrier in the industry and realizing large-scale commercial application;
- Promote the in-depth integration of BCI technology with AI, metaverse, new energy and other fields, expand the ecological boundary, and realize cross-field technical collaboration;
- Achieve complete ecological self-governance, with DAO fully leading technical

routes, scenario expansion, rule formulation and security supervision, forming a self-iterative and self-optimizing ecosystem;

- Help realize Musk's vision of "conceptual-level telepathy" and enable neural value to empower all mankind.

7. Team and Advisors

7.1 Core Team

NLC's core team is composed of neuroscience experts, blockchain technology developers, and crypto-economics scholars, with rich cross-field experience: core members have participated in Neuralink's early technology R&D and Ethereum ecosystem project development. Some members are from top global neuroscience laboratories, with profound technical accumulation and industry resources, providing solid support for ecological implementation.

7.2 Advisory Team

The advisory team covers authoritative figures in neuroscience, cryptocurrency, legal compliance and other fields, including well-known neuroscientists, blockchain industry leaders, and international compliance experts. It provides professional guidance for the project's technical R&D, compliant development, and ecological expansion, ensuring that the project achieves a balance between technological innovation and risk control.

8. Conclusion

Neuralink's technological breakthrough marks that humanity is entering a new era of "neural-machine" collaboration; the decentralized nature of blockchain technology provides a fair, safe, and efficient value base for this transformation. As the core carrier of the integration of these two cutting-edge fields, NeuroLink Coin (NLC) aims to break industry bottlenecks and build a BCI ecosystem where technological innovation, value circulation, and privacy protection coexist harmoniously.

We firmly believe that with the continuous development of the NLC ecosystem, BCI technology will move from medical rigid demand to universal popularization, neural data will become a core personal asset, and "controlling the future with ideas" will no longer be a sci-fi scenario. NLC will work with global ecological participants to jointly promote this technological revolution related to the future of humanity, allowing every individual to benefit from neural value and usher in the era of "neural sovereignty".

Disclaimer

This white paper is only an explanation of the technical and economic model of the NeuroLink Coin (NLC) project and does not constitute any investment advice. BCI technology R&D is uncertain, and the project progress may be adjusted due to factors such as technical bottlenecks and changes in regulatory policies. Investing in NLC involves market risks, technical risks, compliance risks, etc. Investors should carefully assess their own risk-bearing capacity and make rational decisions.