PezkuwiChain: A Sovereign Blockchain for the Kurdish Nation

Technical Whitepaper v2.0

October 21, 2025

Prepared by: Kurdistan Tech Ministry & PezkuwiChain Contributors

Abstract

PezkuwiChain introduces Trust-enhanced Nominated Proof-of-Stake (TNPoS), a novel consensus mechanism that integrates social reputation into blockchain security. Built on Polkadot SDK with a sophisticated dual-token economy (HEZ/PEZ), PezkuwiChain provides a sovereign digital infrastructure for the Kurdish nation, featuring custom pallets for identity, governance, education, and treasury management. This whitepaper presents the technical architecture, economic model, security framework, and strategic roadmap for the world's first trust-augmented Layer-1 blockchain.

Table of Contents

---

1. Executive Summary

PezkuwiChain is a sovereign Layer-1 blockchain network meticulously engineered to serve the digital infrastructure needs of the Kurdistan region and its global diaspora. Built upon the robust and battle-tested Polkadot SDK, PezkuwiChain introduces a novel **Trust-enhanced Nominated Proof-of-Stake (TNPoS)** consensus mechanism, a sophisticated dual-token economic model, and a comprehensive suite of custom-built pallets for governance, identity, and education.

The project's vision is to empower the Kurdish nation through decentralized technology, fostering financial inclusion, digital identity, and a transparent, community-driven ecosystem that integrates social trust into its core consensus layer. This whitepaper provides a comprehensive overview of the PezkuwiChain architecture, its groundbreaking TNPoS consensus, technical specifications, and strategic roadmap.

Key Innovations:

- **TNPoS Consensus:** World's first trust-augmented PoS mechanism
- **Dual-Token Economy:** HEZ (inflationary) + PEZ (fixed 5B supply)
- **Parliamentary NFT System:** 201 governance NFTs with reward mechanisms
- **Custom Pallets:** 10 specialized modules for digital sovereignty
- **Polkadot SDK Foundation:** Battle-tested security and interoperability

2. Introduction

The advent of blockchain technology has unlocked unprecedented opportunities for building decentralized, transparent, and secure digital infrastructures. However, the majority of existing blockchain solutions are designed as general-purpose platforms, often failing to address the specific cultural, economic, and governance needs of distinct communities.

PezkuwiChain emerges from the vision of creating a bespoke digital state for the Kurdish nation, leveraging the power of blockchain to address long-standing challenges and to build a foundation for a prosperous digital future. PezkuwiChain is not merely a cryptocurrency; it is a comprehensive ecosystem designed to provide the tools for digital sovereignty.

The mission is to deliver a public utility that serves the Kurdish people by providing a secure and decentralized platform for financial services, digital identity, democratic governance, and education. This document details the technical and economic architecture of PezkuwiChain, outlining the innovative solutions and strategic vision that will drive its adoption and long-term success.

3. The Problem

Traditional financial and administrative systems often present significant barriers to entry, lack transparency, and are ill-suited to the unique needs of globally distributed yet culturally unified nations. The Kurdish people, numbering in the tens of millions, face distinct challenges that a sovereign digital infrastructure can address:

Financial Exclusion: A significant portion of the population lacks access to modern banking and financial services, hindering economic growth and individual prosperity.

Lack of Digital Sovereignty: The absence of a unified, sovereign digital identity system complicates civic participation, access to services, and legal recognition across borders.

Governance Deficits: Centralized governance models can be opaque and lack mechanisms for broad, democratic participation, failing to capture the collective will of the people.

Economic Volatility: National economies are often susceptible to the volatility of external currencies and geopolitical pressures. A native digital currency can provide a more stable and controlled economic environment.

Trust Deficit in Blockchain: Existing blockchain consensus mechanisms fail to incorporate social trust and reputation, which are fundamental to building resilient and community-driven networks. Pure economic incentives can lead to centralization and misaligned behaviors.

3.1. Competitive Landscape

To understand PezkuwiChain's unique value proposition, we compare it with leading Layer-1 blockchain platforms:

Feature	Ethereum	Polkadot	Cardano	PezkuwiChai
Consensus	PoS	NPoS	Ouroboros PoS	**TNPoS**
Governance	DAO (Off-chain heavy)	OpenGov	Voltaire	**Welati (On-c**
Digital Identity	❌ Third-party	❌ Third-party	⚠️ Atala PRISM	✅ **identity-l**
Education Platform	❌ None	❌ None	❌ None	✅ **perwerde**
Trust Layer	❌ None	❌ None	❌ None	✅ **pallet-tru**
Treasury Model	DAO-based	15% inflation	Protocol fees	**20.25% PEZ**
Cultural Focus	General	General	General	**Kurdish Nati**
Parachain Ready	❌ No	✅ Yes	❌ No	✅ **Yes (Cum**

Key Differentiators:

1. **Trust Integration:** PezkuwiChain is the only blockchain that integrates social reputation directly into consensus
2. **Sovereign Identity:** Built-in KYC/AML compliant identity system (identity-kyc pallet)
3. **Education Infrastructure:** Native education and certification platform (perwerde pallet)
4. **Cultural Alignment:** Designed specifically for Kurdish digital sovereignty
5. **Dual-Token Innovation:** Separate tokens for economic security (HEZ) and governance (PEZ)

4. The Solution: PezkuwiChain Architecture

PezkuwiChain is architected as a comprehensive solution to these challenges, providing a secure, decentralized, and sovereign digital backbone for the Kurdish nation. It is built using the **Polkadot SDK**, a state-of-the-art framework for building next-generation blockchains.

4.1. Foundation: Polkadot SDK & Substrate

The choice of the Polkadot SDK provides PezkuwiChain with a robust, modular, and future-proof foundation. The core of this architecture is **Substrate**, which separates the blockchain's core logic (Runtime) from its client-side functions (Client).

Runtime (State Transition Function): The heart of the blockchain, containing all business logic. It is compiled to WebAssembly (Wasm), allowing for forkless, on-chain upgrades. This

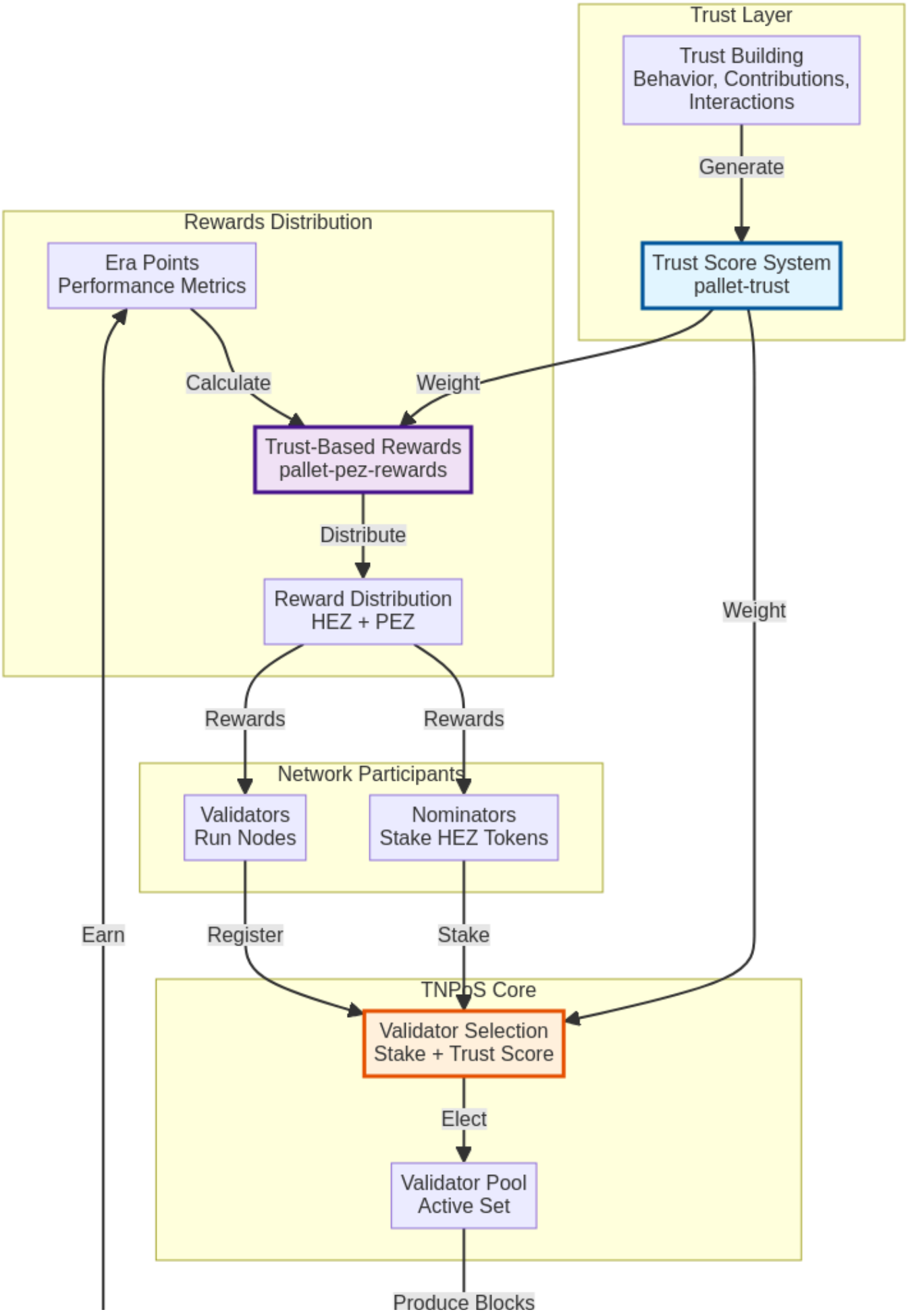
means the network can evolve and adapt without disruptive hard forks.

Client: The native binary that handles networking (via Libp2p), consensus (BABE & GRANDPA), and transaction management. It acts as the host that executes the Wasm runtime.

This modular design, facilitated by the **FRAME** (Framework for Runtime Aggregation of Modularized Entities), allows for the seamless integration of pre-built modules (pallets) and the development of custom logic tailored to the specific needs of PezkuwiChain.

4.2. Consensus Innovation: Trust-enhanced Nominated Proof-of-Stake (TNPoS)

PezkuwiChain introduces a groundbreaking enhancement to the traditional Nominated Proof-of-Stake (NPoS) consensus mechanism by integrating a **Trust System** directly into the validator selection and reward distribution process. This novel approach, termed **TNPoS (Trust-enhanced Nominated Proof-of-Stake)**, combines the economic security of NPoS with the social reputation layer provided by the custom **pallet-trust**.


Trust Layer
Trust Building
Behavior, Contributions,
Interactions
Generate
Trust Score System
pallet-trust
Rewards Distribution
Era Points
Performance Metrics
Calculate
Weight
Trust-Based Rewards
pallet-pez-rewards
Distribute
Reward Distribution
HEZ + PEZ
Weight
Rewards
Rewards
Network Participants
Validators
Run Nodes
Nominators
Stake HEZ Tokens
Earn
Register
Stake
TNPoS Core
Validator Selection
Stake + Trust Score
Elect
Validator Pool
Active Set
Produce Blocks

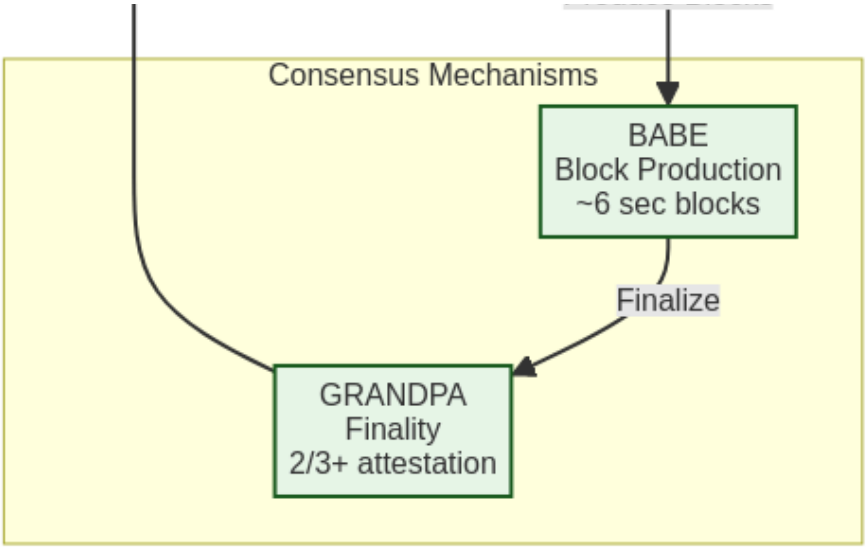


Figure 1: TNPoS Consensus Flow - Integration of Trust Scores into Validator Selection and Rewards

4.2.1. Core Components of TNPoS

Traditional NPoS Foundation: TNPoS builds upon Polkadot's proven NPoS model, where Validators are responsible for producing blocks and finalizing the chain, while Nominators stake their tokens to support and elect trusted Validators. This system democratizes participation in network security and ensures a high level of economic security.

Trust Score Integration: The **pallet-trust** introduces a social trust and reputation system that allows network participants to build trust scores based on their behavior, contributions, and interactions within the ecosystem. These trust scores are not merely cosmetic; they are integrated into the consensus layer through the **pallet-pez-rewards** mechanism.

Trust-Weighted Validator Selection: In TNPoS, validator selection is not solely based on the amount of stake but is also influenced by the trust scores of both Validators and their Nominators. This ensures that validators with higher community trust and proven track records are more likely to be elected, enhancing the overall reliability and security of the network.

Trust-Based Reward Distribution: The **pallet-pez-rewards** utilizes trust scores to calculate and distribute rewards. Validators and Nominators with higher trust scores receive proportionally higher rewards, creating a positive feedback loop that incentivizes good behavior, long-term commitment, and active participation in the network's governance and security.

4.2.2. Block Production and Finality

PezkuwiChain utilizes a hybrid consensus mechanism for block production and finality:

BABE (Blind Assignment for Blockchain Extension) is responsible for block production. BABE is a slot-based protocol that randomly assigns block production rights to Validators, preventing censorship and ensuring a consistent block time of approximately 6 seconds.

GRANDPA (GHOST-based Recursive ANcestor Deriving Prefix Agreement) serves as the finality gadget for the chain. GRANDPA allows a large set of Validators to agree on the finality of blocks in a way that is both fast and provably secure. A block is considered final once it has been attested to by a supermajority (2/3+) of Validators.

4.2.3. Innovation and Contribution to Blockchain Technology

TNPoS represents a significant innovation in blockchain consensus design. By integrating social trust into the economic security model, PezkuwiChain creates a more resilient, community-aligned, and sustainable network.

Comparison with Traditional Consensus Mechanisms:

Feature	PoW (Bitcoin)	PoS (Ethereum)	NPoS (Polkadot)	TNPo
Energy Efficiency	❌ Very Low	✅ High	✅ High	✅ Hi
Validator Selection	Mining Power	Stake Amount	Stake + Nomination	**Stak**
Reward Distribution	Mining Rewards	Stake-weighted	Equal Base + Era Points	**Trust**
Centralization Risk	Medium-High	High	Low-Medium	**Very**
Social Layer	❌ None	❌ None	❌ None	✅ **Tr**
Governance Integration	❌ Off-chain	⚠️ Partial	✅ Full (OpenGov)	✅ **Fu**
Slashing Mechanism	N/A	✅ Yes	✅ Yes	✅ **Ye**
Sybil Resistance	High Cost	High Cost	High Cost	**High**

This approach addresses a critical gap in existing PoS systems, where purely economic incentives can sometimes lead to centralization or misaligned behaviors. TNPoS ensures that the network is secured not only by capital but also by reputation and community trust, making it uniquely suited for a sovereign digital state.

4.3. System Architecture

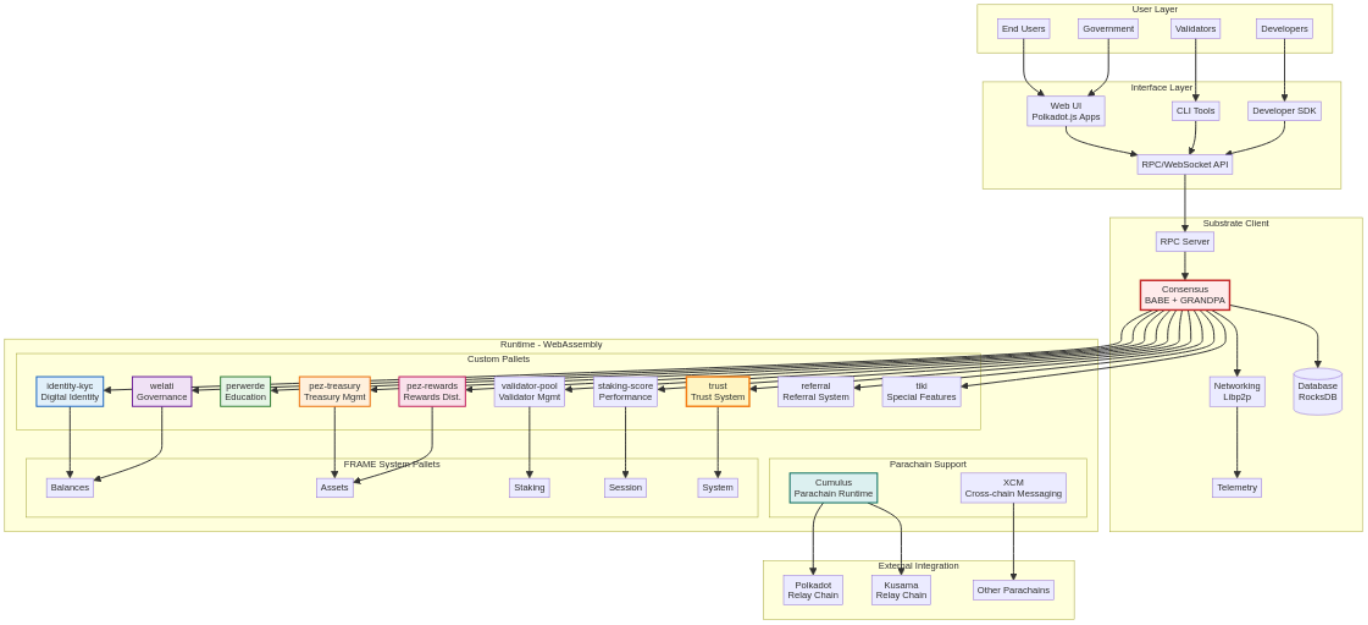


Figure 2: PezkuwiChain System Architecture - Layered view from users to runtime pallets

The architecture follows a layered approach:

1. **User Layer:** End users, validators, developers, and government entities
2. **Interface Layer:** Web UI, CLI tools, RPC/WebSocket APIs, and SDKs
3. **Client Layer:** Substrate client with networking, consensus, and database
4. **Runtime Layer:** Custom pallets and FRAME system pallets in WebAssembly
5. **Integration Layer:** Cumulus for parachain support and XCM for cross-chain communication

5. Dual-Token Economic Model

PezkuwiChain introduces an innovative dual-token economic model to create a balanced and sustainable ecosystem that serves both the public and governmental functions. The two native tokens, **HEZ** and **PEZ**, are designed with distinct purposes and monetary policies.

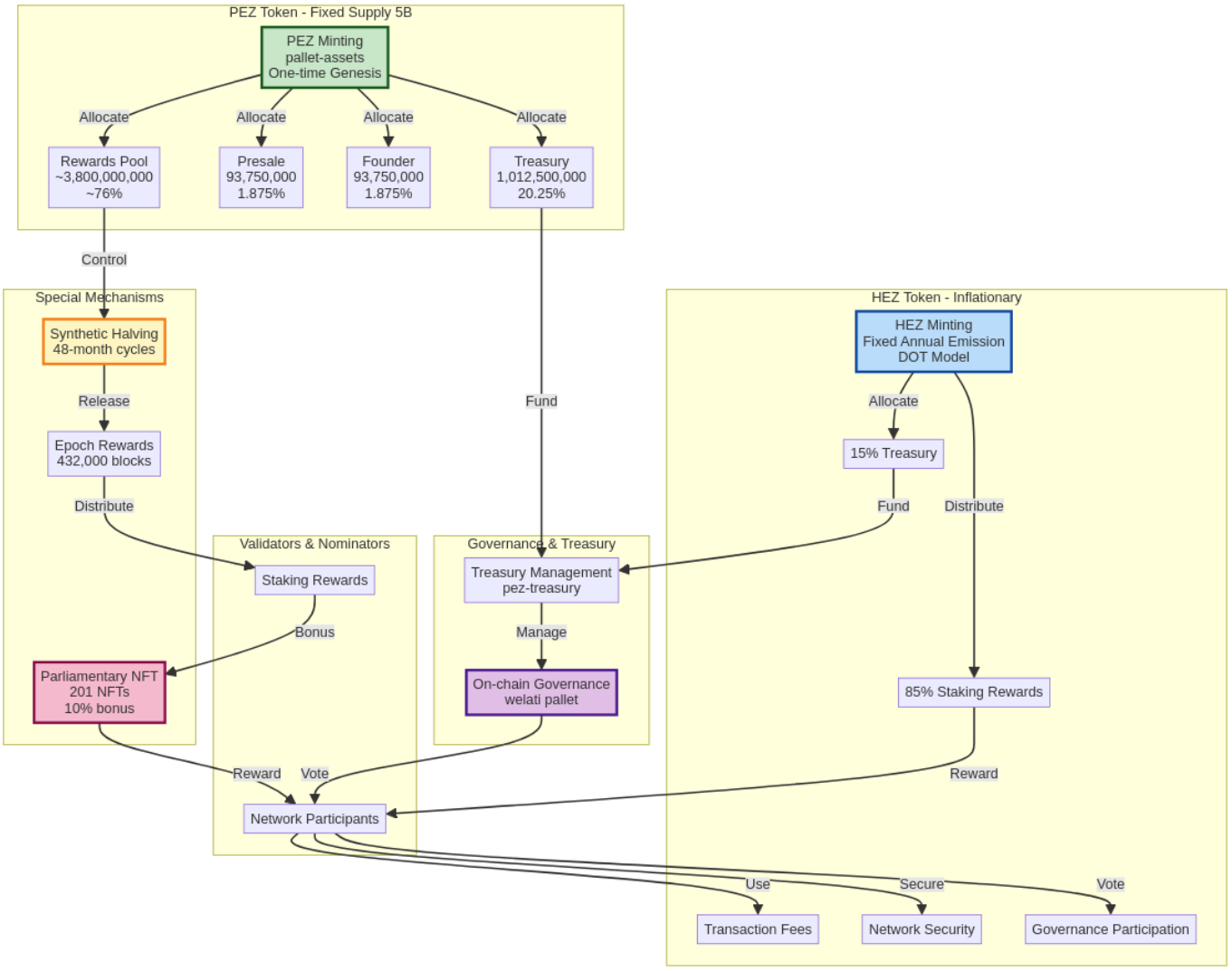


Figure 3: Dual-Token Economy Flow - HEZ and PEZ token distribution and utility

Feature	HEZ Token	PEZ Token
Target User	General Population	Kurdistan Government & Gov
Purpose	Daily transactions, network fees, staking	Governance, treasury funding
Supply Model	Inflationary (Standard DOT Model)	Fixed Supply (5 Billion)
Monetary Policy	Dynamic inflation to secure network via staking	Synthetic Halving (48-month
Foundation	Based on Polkadot's battle-tested standards	Custom-minted via pallet-ass
Decimal Places	10 (DOT standard)	12

5.1. HEZ: The People's Currency

HEZ is the native, inflationary cryptocurrency of the PezkuwiChain network, fully aligned with the standard DOT token model in the Polkadot ecosystem. Its primary role is to secure the network through staking and to serve as the primary medium of exchange for transaction fees and daily economic activity. The inflationary model is designed to continuously incentivize network participation and reward Validators and Nominators for securing the chain. The inflation rate is dynamic, adjusting based on the staking rate to maintain optimal network security.

5.1.1. HEZ Token Economics

HEZ follows the proven economic model established by Polkadot's DOT token, which has been successfully securing the Polkadot network since its inception. The key characteristics of the HEZ token economy are as follows:

Inflation Model: HEZ employs a **fixed annual emission model** similar to Polkadot's post-November 2024 tokenomics. The network mints a predetermined amount of HEZ tokens annually, which are distributed to network participants according to a carefully designed allocation strategy. This linear issuance model ensures predictable token supply growth while maintaining strong security incentives.

Staking Rewards Distribution: The annual HEZ emission is allocated with a primary focus on network security and ecosystem sustainability. Following the Polkadot standard, approximately **85% of the annual inflation** is directed to staking rewards, distributed among Validators and their Nominators. The remaining **15%** flows into the network treasury to fund ecosystem development, community proposals, and public goods. This distribution ensures that the majority of newly minted tokens directly incentivize network security while maintaining a sustainable funding mechanism for long-term growth.

Equal Validator Rewards: One of the most innovative aspects of the NPoS system, inherited by PezkuwiChain's TNPoS, is that all active Validators receive **equal base rewards** regardless of the total stake backing them. This design choice is intentional and serves to prevent the centralization of power among a few heavily-staked validators. Instead, it encourages a more distributed validator set and allows smaller validators to compete effectively with larger ones. However, within this equal distribution framework, Validators can earn additional **era points** based on their on-chain activity and performance, creating a merit-based bonus system that rewards active and reliable validators.

Dynamic Inflation Mechanism: While the base emission is fixed, the effective inflation rate (as a percentage of total supply) naturally decreases over time as the total supply grows. This creates a gradually deflationary pressure that balances the need for security incentives with long-term token value preservation. The staking rewards are calibrated to maintain an **ideal staking rate** on the network (typically around 50-75% of total supply). If the actual staking rate falls below this target, the rewards become more attractive relative to the

circulating supply, incentivizing more participants to stake. Conversely, if staking exceeds the target rate, the relative returns decrease, encouraging some participants to unstake and use their tokens for other purposes within the ecosystem.

Unbonding Period and Security: To ensure network security and prevent "nothing at stake" attacks, HEZ implements an **unbonding period** of approximately **28 days** (following the Polkadot standard). During this period, tokens that have been unstaked remain locked and do not earn rewards. This mechanism provides a critical security buffer, allowing the network to identify and punish malicious behavior even after it occurs, as validators and nominators remain accountable for their actions during past eras.

Slashing for Misbehavior: The security of the HEZ staking system is enforced through **slashing**, a mechanism where validators (and their nominators) can lose a portion of their staked tokens if the validator is found to be acting maliciously or negligently. This creates strong economic disincentives for bad behavior and ensures that all participants have "skin in the game." The severity of slashing depends on the nature and scale of the offense, ranging from minor penalties for unintentional downtime to severe slashing for provable malicious attacks.

Token Utility: Beyond staking, HEZ serves as the fundamental utility token for all network operations. It is used to pay transaction fees, execute smart contracts, participate in governance (alongside PEZ), and access network services. This multi-faceted utility ensures consistent demand for HEZ tokens and creates a robust token economy that supports the network's long-term sustainability.

5.2. PEZ: The Governance & Rewards Token

PEZ is a fixed-supply token with a total of **5 billion** units, designed for governance, treasury funding, and reward distribution. PEZ is minted using the **pallet-assets** framework and features a sophisticated distribution mechanism with a **synthetic halving schedule** that occurs every **48 months (4 years)**, mirroring Bitcoin's halving philosophy but adapted for a governance-focused token.

5.2.1. PEZ Token Distribution (Based on On-Chain Implementation)

The PEZ token distribution is hardcoded into the **pallet-pez-treasury** and reflects a carefully designed allocation strategy:

Allocation Category	Amount (PEZ)	Percentage	Purpose
Treasury	1,012,500,000	20.25%	On-chain treasury to fund community pro ecosystem development, and public gooc
Presale	93,750,000	1.875%	Initial distribution to early supporters anc members.
Founder	93,750,000	1.875%	Allocation for the founding team, subject vesting.
Rewards & Ecosystem	~3,800,000,000	~76%	Allocated for staking rewards, incentive p Parliamentary NFT rewards, and ecosyste

Total Supply: 5,000,000,000 PEZ

Technical Constants (from pallet-pez-treasury):

Rust

```rust
pub const TOTAL_SUPPLY: u128 = 5_000_000_000 * 1_000_000_000_000; // 12 decimals
pub const TREASURY_ALLOCATION: u128 = 1_012_500_000 * 1_000_000_000_000;
pub const PRESALE_ALLOCATION: u128 = 93_750_000 * 1_000_000_000_000;
pub const FOUNDER_ALLOCATION: u128 = 93_750_000 * 1_000_000_000_000;
```

5.2.2. Synthetic Halving Mechanism

The PEZ token employs a synthetic halving mechanism with the following parameters:

Technical Constants (from pallet-pez-treasury):

Rust

```rust
pub const HALVING_PERIOD_MONTHS: u32 = 48; // 4 years
pub const BLOCKS_PER_MONTH: u32 = 432_000; // ~30 days
pub const HALVING_PERIOD_BLOCKS: u32 = 20_736_000; // 48 months in blocks
```

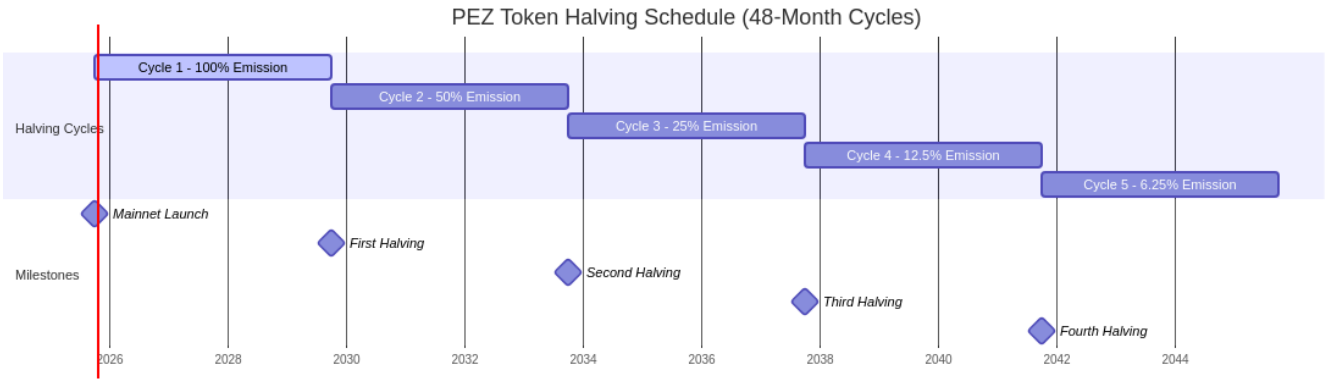


Figure 4: PEZ Token Halving Schedule - 48-month cycles over 20 years

This halving mechanism controls the release of PEZ tokens from the rewards and ecosystem allocation, ensuring a predictable and deflationary distribution over time.

5.3. Economic Simulations and Projections

5.3.1. HEZ Inflation Projections

Assuming a fixed annual emission similar to Polkadot's 120M DOT model (scaled appropriately for PezkuwiChain):

Year	Total Supply (Estimated)	Annual Inflation Rate	Staking Rewards	Treasury Allocati
1	100M HEZ	10.0%	8.5M HEZ	1.5M HEZ
5	150M HEZ	6.7%	8.5M HEZ	1.5M HEZ
10	200M HEZ	5.0%	8.5M HEZ	1.5M HEZ
20	300M HEZ	3.3%	8.5M HEZ	1.5M HEZ

Note: Actual emission rates will be determined through governance and adjusted based on network security needs.

5.3.2. PEZ Distribution Timeline

Cycle	Years	Emission Rate	Cumulative Distribution	Remaining Supply
Genesis	0	-	1.2B (Treasury+Presale+Founder)	3.8B
1	0-4	100%	+1.9B	1.9B
2	4-8	50%	+950M	950M
3	8-12	25%	+475M	475M
4	12-16	12.5%	+237.5M	237.5M
5	16-20	6.25%	+118.75M	118.75M

5.3.3. Staking Participation Scenarios

Scenario	Staking Rate	Annual HEZ Reward (per 1000 HEZ)	Network Security	Liqui
Low Participation	30%	~28 HEZ	⚠️ Vulnerable	✅ H
Optimal	60%	~14 HEZ	✅ Secure	✅ B
High Participation	80%	~10.6 HEZ	✅ Very Secure	⚠️ L

6. Core Features & Custom Pallets

PezkuwiChain extends the core functionality of the Polkadot SDK with a suite of custom-built pallets, each designed to address a specific need within the Kurdish digital state ecosystem.

Pallet	Description	Key Features
identity-kyc	A comprehensive digital identity system, enabling secure and verifiable citizen registration and KYC/AML processes.	Sovereign ID, KYC/
welati	The cornerstone of PezkuwiChain's democratic governance, allowing for on-chain proposals, voting, and referendums. The name means "citizen" in Kurdish.	On-chain voting, P
perwerde	A decentralized platform for education and certification, providing a trustless way to issue and verify credentials. The name means "education" in Kurdish.	Certificate issuanc tracking
pez-treasury	Manages the PEZ token treasury with hardcoded allocations for treasury (20.25%), presale (1.875%), and founder (1.875%). Implements the 48-month synthetic halving mechanism.	Treasury managem allocation
pez-rewards	Implements the trust-based reward distribution mechanism. Features epoch-based rewards (432,000 blocks/epoch), Parliamentary NFT rewards (10% of incentive pool for 201 NFT holders), and claim periods (100,800 blocks). Integrates with pallet-trust for trust-weighted rewards.	Trust-weighted rew Claim periods
validator-pool	A system for managing pools of validators, simplifying the process for users to participate in network security.	Pool management coordination
staking-score	A performance and reputation system for validators and nominators, promoting network health and reliability.	Performance track
trust	The social trust and reputation system that powers TNPoS. Allows users to build trust networks and provides trust scores used in validator selection and reward distribution.	Trust scoring, Repu integration
referral	A mechanism to incentivize user growth and network adoption through referral rewards.	Referral tracking, G
tiki	A specialized pallet for unique ecosystem features.	Custom functional

6.1. Parliamentary NFT System

PezkuwiChain introduces a novel **Parliamentary NFT** system integrated into the **pallet-pez-rewards**. This system consists of:

Technical Constants (from pallet-pez-rewards):

Rust

```rust
pub const PARLIAMENTARY_COLLECTION_ID: u32 = 100;
pub const PARLIAMENTARY_NFT_COUNT: u32 = 201;
pub const PARLIAMENTARY_REWARD_PERCENT: u32 = 10; // 10% of incentive pool
```

Features:

- **Collection ID:** 100
- **NFT Count:** 201 unique Parliamentary NFTs
- **Reward Allocation:** 10% of the incentive pool is distributed among Parliamentary NFT holders
- **Governance Role:** NFT holders may represent parliamentary seats or special governance roles

This mechanism creates a unique governance and incentive structure, where holders of these limited NFTs receive additional rewards and potentially enhanced voting power in the welati governance system.

6.2. Epoch and Reward Mechanics

Technical Constants (from pallet-pez-rewards):

Rust

```rust
pub const BLOCKS_PER_EPOCH: u32 = 432_000; // ~30 days
pub const CLAIM_PERIOD_BLOCKS: u32 = 100_800; // ~7 days
```

Reward Distribution Flow:

1. **Epoch Duration:** 432,000 blocks (~30 days at 6-second block time)
2. **Reward Calculation:** Based on trust scores from pallet-trust
3. **Claim Period:** 100,800 blocks (~7 days) to claim rewards
4. **Clawback:** Unclaimed rewards are returned to the incentive pot
5. **Parliamentary Bonus:** 10% of pool distributed to 201 NFT holders

7. Technical Specifications

PezkuwiChain's technical architecture is engineered for security, scalability, and interoperability, leveraging the cutting-edge technologies of the Polkadot ecosystem.

Specification	Value	Description
Framework	Polkadot SDK / Substrate	Modular blockchain framework
Programming Language	Rust	Memory-safe systems programmin
Consensus	TNPoS (BABE + GRANDPA + Trust)	Trust-enhanced Nominated Proof-c
Block Time	~6 seconds	BABE slot-based production
Finality	~12-18 seconds	GRANDPA finality gadget
Epoch Duration	432,000 blocks (~30 days)	PEZ reward distribution period
Era Duration	~24 hours	HEZ staking reward period
Unbonding Period	~28 days	Security buffer for slashing
Runtime Environment	WebAssembly (Wasm)	Forkless upgrades
Networking	Libp2p	Modular P2P networking
Database	RocksDB	Persistent state storage
Parachain Compatibility	Cumulus	Polkadot/Kusama integration
Cross-Chain	XCM	Cross-Consensus Messaging
HEZ Decimals	10	1 HEZ = 10^10 Planck
PEZ Decimals	12	1 PEZ = 10^12 units
Max Validators	Configurable (starts at 100)	Scales with network growth
Max Nominators	Unlimited	Via nomination pools

8. Network Architecture

The PezkuwiChain network is a decentralized system of nodes that work together to maintain the integrity and security of the blockchain. The architecture is designed to be resilient, scalable, and censorship-resistant.

8.1. Node Types

Validator Nodes: Full nodes that participate in consensus by producing blocks (via BABE) and voting on finality (via GRANDPA). Validators must stake HEZ tokens and maintain high

uptime and performance. They are selected based on stake and trust scores in the TNPoS system.

Nominator Nodes: Participants who stake HEZ tokens to back trusted validators. Nominators share in the rewards earned by their chosen validators and are also subject to slashing if their validators misbehave.

Full Nodes: Non-validating nodes that maintain a complete copy of the blockchain state. They serve RPC requests, relay transactions, and help propagate blocks across the network.

Light Clients: Lightweight nodes that only download block headers and request specific data on demand. They enable mobile and browser-based applications to interact with the chain without storing the full state.

8.2. Network Topology

The network utilizes Libp2p for peer-to-peer communication, providing:

- **Peer Discovery:** DHT-based discovery and mDNS for local networks
- **Transport Security:** Noise protocol for encrypted connections
- **Multiplexing:** Yamux for efficient connection management
- **NAT Traversal:** Automatic hole-punching for firewall bypass

8.3. Telemetry and Monitoring

PezkuwiChain nodes can optionally report telemetry data to public dashboards, providing transparency into network health, validator performance, and geographic distribution.

9. Governance Model

PezkuwiChain is committed to a fully decentralized, on-chain governance model that empowers its community. The **welati** pallet is the cornerstone of this democratic system, providing the framework for proposals, voting, and the autonomous enactment of network upgrades.

9.1. Governance Mechanisms

Proposals: Any PEZ holder can submit a proposal for network changes, treasury spending, or policy decisions. Proposals require a minimum deposit to prevent spam.

Council: An elected body of representatives who can fast-track proposals and represent passive stakeholders. Council members are elected through approval voting.

Technical Committee: A group of core developers and technical experts who can fast-track urgent bug fixes and security patches.

Referendums: All major decisions are put to a public vote where all PEZ holders can participate. Voting power is weighted by stake and may be enhanced by conviction (time-locking tokens for stronger votes).

Enactment: Approved proposals are automatically enacted on-chain after a delay period, allowing for emergency cancellation if critical issues are discovered.

9.2. Treasury Management

The **pez-treasury** pallet manages a decentralized treasury with a hardcoded allocation of **1,012,500,000 PEZ (20.25% of total supply)**. Additionally, **15% of HEZ inflation** flows into the treasury. This treasury is funded at genesis and through ongoing inflation, and can be allocated to fund projects and initiatives that benefit the network.

Spending Proposals: Community members can submit proposals to request treasury funds for development, marketing, research, or other ecosystem benefits.

Approval Process: Spending proposals are voted on through the governance mechanism, requiring approval from PEZ holders and/or the Council.

Burn Mechanism: Unspent treasury funds may be periodically burned to create deflationary pressure, subject to governance decisions.

9.3. Trust-Enhanced Governance

The integration of the **pallet-trust** system into governance creates unique dynamics:

- **Trust-Weighted Voting:** Participants with higher trust scores may receive enhanced voting power
- **Reputation-Based Proposals:** High-trust members may have lower proposal deposits
- **Validator Governance:** Validators with proven track records have stronger influence in technical decisions

9.4. Risk Factors and Mitigation Strategies

While PezkuwiChain is designed with security and resilience in mind, all blockchain systems face inherent risks. This section outlines the primary risk categories and the mitigation strategies employed.

9.4.1. Technical Risks

Smart Contract Vulnerabilities:

- **Risk:** Bugs in runtime pallets could lead to exploits, fund loss, or network disruption
- **Mitigation:**

- Comprehensive unit and integration testing
- Formal verification of critical pallets
- Independent security audits by reputable firms
- Bug bounty program with substantial rewards
- Gradual rollout with testnet validation

Runtime Upgrade Failures:

- **Risk:** Forkless upgrades could introduce breaking changes or incompatibilities
- **Mitigation:**
  - Extensive testing on testnets before mainnet deployment
  - Multi-stage upgrade process with rollback capabilities
  - Technical Committee oversight for emergency fixes
  - Community review period before enactment

Consensus Failures:

- **Risk:** TNPoS implementation bugs could compromise finality or liveness
- **Mitigation:**
  - Building on battle-tested Polkadot SDK foundation
  - Incremental trust system integration
  - Fallback to standard NPoS if trust system fails
  - Continuous monitoring and alerting

9.4.2. Economic Risks

Token Volatility:

- **Risk:** HEZ and PEZ price fluctuations could affect network security and adoption
- **Mitigation:**
  - Dual-token model separates utility from governance
  - Staking incentives maintain consistent security budget
  - Treasury reserves to stabilize during market stress
  - Gradual token distribution via halving mechanism

Insufficient Staking Participation:

- **Risk:** Low staking rates could compromise network security
- **Mitigation:**

    - Dynamic inflation adjusts rewards to incentivize staking
    - Nomination pools lower barrier to entry
    - Trust-based rewards create additional incentives
    - Educational campaigns on staking benefits

Treasury Depletion:

- **Risk:** Excessive spending could drain treasury reserves
- **Mitigation:**
    - Governance approval required for all spending
    - Dual funding (PEZ + HEZ inflation)
    - Periodic burn of unspent funds
    - Long-term budget planning

9.4.3. Governance Risks

Low Voter Turnout:

- **Risk:** Apathy could lead to decisions made by small minorities
- **Mitigation:**
    - Trust-weighted voting rewards active participants
    - Council representation for passive stakeholders
    - User-friendly governance interfaces
    - Community engagement and education

Malicious Proposals:

- **Risk:** Attackers could submit harmful proposals
- **Mitigation:**
    - Proposal deposits create economic barriers
    - Community review and discussion periods
    - Council and Technical Committee veto powers
    - Emergency cancellation mechanisms

Governance Capture:

- **Risk:** Wealthy actors could dominate decision-making
- **Mitigation:**
    - Trust scores balance pure plutocracy

- Conviction voting rewards long-term commitment
- Diverse stakeholder representation in Council
- Transparent on-chain voting records

9.4.4. Operational Risks

Validator Centralization:

- **Risk:** Geographic or entity concentration could threaten decentralization
- **Mitigation:**
  - Equal base rewards prevent stake concentration
  - Trust scores favor distributed, reliable validators
  - Nomination pools enable broad participation
  - Geographic diversity incentives

Network Attacks:

- **Risk:** DDoS, eclipse, or long-range attacks
- **Mitigation:**
  - Libp2p's robust networking layer
  - 28-day unbonding period prevents long-range attacks
  - Slashing deters malicious behavior
  - Diverse validator set increases attack cost

9.4.5. Regulatory and Compliance Risks

Legal Uncertainty:

- **Risk:** Evolving regulations could impact operations
- **Mitigation:**
  - KYC/AML-capable identity-kyc pallet
  - Transparent governance and treasury
  - Legal counsel and compliance monitoring
  - Flexible architecture for regulatory adaptation

9.5. Risk Management Framework

PezkuwiChain employs a continuous risk management process:

1. **Identification:** Regular security audits and community reporting

2. **Assessment:** Technical Committee evaluates severity and likelihood
3. **Mitigation:** Implement technical and governance solutions
4. **Monitoring:** Ongoing surveillance of network metrics
5. **Response:** Emergency procedures for critical incidents

10. Security and Auditing

Security is a paramount concern for PezkuwiChain. The project leverages multiple layers of security, from the choice of Rust programming language to the design of its core protocols.

10.1. Security Layers

Language-Level Security: Rust's memory safety guarantees eliminate entire classes of vulnerabilities (buffer overflows, use-after-free, data races) that plague C/C++ blockchain implementations.

Framework Security: The Polkadot SDK has been battle-tested securing billions of dollars across Polkadot, Kusama, and numerous parachains.

Forkless Upgrades: WebAssembly runtime allows for security patches without network disruption or contentious hard forks.

Economic Security: TNPoS with slashing ensures validators have strong economic incentives to behave honestly.

Social Security: Trust system adds reputation layer, making attacks costly not just economically but socially.

10.2. Audit Strategy

Phase 1 - Internal Audits: Core team conducts comprehensive code reviews and security analysis.

Phase 2 - External Audits: Independent security firms audit critical pallets (pez-treasury, pez-rewards, trust, identity-kyc).

Phase 3 - Ongoing Monitoring: Continuous security monitoring and incident response procedures.

10.3. Bug Bounty Program

PezkuwiChain will establish a bug bounty program with rewards scaled by severity:

Severity	Description	Reward Range
Critical	Consensus failure, fund theft, network halt	50,000 - 200,000 USD
High	DoS attacks, privilege escalation	10,000 - 50,000 USD
Medium	Information disclosure, minor exploits	2,000 - 10,000 USD
Low	Best practice violations, code quality	500 - 2,000 USD

10.4. Incident Response

In the event of a security incident:

1. **Detection:** Automated monitoring and community reporting
2. **Assessment:** Technical Committee evaluates severity
3. **Containment:** Emergency runtime upgrade if necessary
4. **Remediation:** Patch deployment and validator coordination
5. **Post-Mortem:** Public disclosure and lessons learned

10.5. Environmental Sustainability

PezkuwiChain's Proof-of-Stake consensus provides significant environmental advantages over Proof-of-Work systems:

Energy Efficiency Comparison:

Blockchain	Consensus	Annual Energy Consumption	Transactions per kWh
Bitcoin	PoW	~150 TWh	~5
Ethereum (pre-merge)	PoW	~100 TWh	~15
Ethereum (post-merge)	PoS	~0.01 TWh	~1,000,000
Polkadot	NPoS	~0.005 TWh	~2,000,000
PezkuwiChain	**TNPoS**	**~0.003 TWh (est.)**	**~2,500,000 (est.)**

Carbon Footprint: PezkuwiChain's estimated carbon footprint is approximately **99.99% lower** than Bitcoin, making it one of the most environmentally sustainable blockchain

networks.

Green Initiatives:

- Validator incentives for renewable energy usage
- Carbon offset programs funded by treasury
- Certification pursuit for green blockchain standards
- Educational campaigns on sustainable blockchain technology

11. Roadmap & Development Phases

PezkuwiChain follows a phased development roadmap to ensure a stable, secure, and feature-rich mainnet launch.

Phase	Status	Timeline	Key Achievements
Alfa Testnet	✅ Complete	Q1 2024	Initial network launch, successful deployme of core functionalities.
Beta Testnet Phase 1	✅ Complete	Q2 2024	Introduction of the beta testnet, with a focus stability and validator participation.
Beta Testnet Phase 2	✅ Complete	Q3 2024	Integration and testing of pallet-pez-treasury pez-rewards with dual-token economy.
Phase 3.1	✅ Complete	Q4 2024	Publication of comprehensive Beta Testnet d including user and validator guides.
Phase 4	✅ Complete	Q1 2025	Benchmarking of all custom pallets to deter appropriate transaction weights.
Phase 5	🔄 In Progress	Q2 2025	Full workspace benchmarking and final prep mainnet.
Security Audits	🔜 Upcoming	Q3 2025	Independent security audits of critical pallet firms.
Parliamentary NFT	🔜 Upcoming	Q3 2025	Integration and deployment of the Parliame system for governance and rewards.
Mainnet Launch	🔜 Upcoming	Q4 2025	The official launch of the PezkuwiChain sove blockchain network.
Parachain Integration	🔮 Future	2026	Connection to Polkadot or Kusama relay cha parachain.
XCM Bridges	🔮 Future	2026	Cross-chain bridges to major blockchain eco

11.1. Post-Mainnet Roadmap

Year 1 (2026):

- Ecosystem grants program launch
- DApp developer onboarding
- Identity-kyc adoption by government services
- Perwerde education platform pilot programs

Year 2 (2027):

- Parachain slot acquisition (Polkadot or Kusama)

- XCM integration with major parachains
- DeFi ecosystem expansion (DEX, lending, stablecoins)
- Mobile wallet and light client releases

Year 3 (2028+):

- Layer-2 scaling solutions
- Privacy features (zero-knowledge proofs)
- Interoperability with non-Polkadot chains
- Global expansion beyond Kurdish diaspora

12. Use Cases & Applications

PezkuwiChain is designed to be a foundational layer for a wide range of decentralized applications and services that serve the Kurdish nation and beyond.

12.1. Digital Identity and Citizenship

identity-kyc Pallet Applications:

- **National Digital ID:** Sovereign digital identity for all citizens, replacing physical documents
- **Cross-Border Recognition:** Verifiable credentials accepted across Kurdish regions
- **KYC/AML Compliance:** Financial institutions can verify identity without storing personal data
- **Healthcare Records:** Secure, portable medical records controlled by individuals
- **Voting Rights:** Cryptographic proof of citizenship for welati governance participation

Example Use Case: A Kurdish citizen in diaspora can prove their identity to access government services, vote in referendums, and open bank accounts without physical documents.

12.2. Democratic Governance

welati Pallet Applications:

- **National Referendums:** Direct democracy on constitutional and policy matters
- **Local Governance:** Regional and municipal decision-making
- **Budget Allocation:** Participatory budgeting for public funds
- **Transparency:** All proposals, votes, and spending publicly auditable

- **Delegation:** Liquid democracy allowing vote delegation to trusted representatives

Example Use Case: A community proposal to fund a new school is submitted, debated, voted on, and automatically funded from the treasury—all transparently on-chain.

12.3. Education and Credentials

perwerde Pallet Applications:

- **Academic Certificates:** Tamper-proof diplomas and degrees
- **Professional Licenses:** Verifiable credentials for doctors, engineers, lawyers
- **Skill Badges:** Micro-credentials for specific competencies
- **Continuing Education:** Lifelong learning records
- **Employer Verification:** Instant, trustless credential verification

Example Use Case: A university issues a blockchain-based diploma that employers can instantly verify without contacting the institution, eliminating credential fraud.

12.4. Decentralized Finance (DeFi)

Financial Infrastructure:

- **Decentralized Exchanges (DEX):** HEZ/PEZ and other token trading
- **Lending Protocols:** Collateralized loans using HEZ as collateral
- **Stablecoins:** Kurdish Dinar-pegged stablecoins for price stability
- **Cross-Border Payments:** Instant, low-cost remittances for diaspora
- **Yield Farming:** Liquidity provision rewards for DeFi participants

Example Use Case: A worker in Europe sends remittances to family in Kurdistan instantly via HEZ transfer, avoiding high fees and delays of traditional banking.

12.5. Supply Chain and Trade

- **Origin Verification:** Track Kurdish products from source to consumer
- **Trade Finance:** Smart contracts for international trade agreements
- **Customs and Tariffs:** Automated duty collection and compliance
- **Quality Assurance:** Immutable records of inspections and certifications

12.6. Social Impact

- **Charitable Giving:** Transparent donation tracking to NGOs
- **Refugee Assistance:** Digital identity for displaced persons

- **Land Registry:** Immutable property records preventing disputes
- **Cultural Preservation:** NFTs for Kurdish art, music, and literature

13. Team & Contributors

PezkuwiChain is an initiative led by the **Kurdistan Tech Ministry**, reflecting a strong commitment to leveraging cutting-edge technology for national development. The project benefits from a global community of **156 contributors** (as of October 2025) who have dedicated their expertise to building the PezkuwiChain ecosystem.

13.1. Core Team

Kurdistan Tech Ministry: The governmental body overseeing the strategic direction and funding of the project. Ensures alignment with national digital infrastructure goals.

Technical Leadership: Experienced blockchain architects and Rust developers with backgrounds in Polkadot, Substrate, and distributed systems.

Research Team: Cryptographers, economists, and computer scientists advancing TNPoS consensus and tokenomics research.

Community Managers: Building and nurturing the global Kurdish developer and user community.

13.2. Contributors

The project's **156 contributors** span multiple disciplines:

- **Core Developers:** Runtime development, pallet implementation, consensus engineering
- **Infrastructure:** Node operators, DevOps, network monitoring
- **Documentation:** Technical writers, translators (Kurdish, English, Arabic, Turkish)
- **Design:** UI/UX designers for wallets and dApps
- **Community:** Moderators, educators, event organizers

13.3. Advisors

Technical Advisors: Polkadot ecosystem veterans, Substrate experts, and security researchers.

Economic Advisors: Tokenomics specialists and financial economists.

Legal Advisors: Blockchain regulation experts and compliance specialists.

Cultural Advisors: Kurdish community leaders ensuring cultural alignment.

14. Ecosystem & Partnerships

PezkuwiChain is designed to be a vibrant and interconnected ecosystem. Its foundation on the Polkadot SDK provides inherent interoperability with one of the most active blockchain ecosystems in the world.

14.1. Polkadot Ecosystem Integration

Parachain-Ready Architecture: PezkuwiChain is built with Cumulus, making it ready to connect to Polkadot or Kusama relay chains as a parachain. This would grant:

- **Shared Security:** Leveraging the economic security of the relay chain's validator set
- **Interoperability:** Native XCM communication with hundreds of other parachains
- **Scalability:** Parallel transaction processing across the Polkadot network

XCM Integration: Cross-Consensus Messaging enables:

- Asset transfers between PezkuwiChain and other parachains
- Remote smart contract calls
- Cross-chain governance participation
- Shared liquidity pools

14.2. Strategic Partnerships

Educational Institutions:

- Universities for perwerde credential issuance pilots
- Vocational schools for skill certification programs
- Research collaborations on blockchain technology

Government Entities:

- Regional governments for identity-kyc adoption
- Ministries for welati governance integration
- Customs and trade departments for supply chain tracking

NGOs and Civil Society:

- Humanitarian organizations for refugee assistance
- Cultural organizations for heritage preservation
- Diaspora associations for community engagement

Private Sector:

- Financial institutions for DeFi integration
- Technology companies for dApp development
- Infrastructure providers for node hosting

14.3. Developer Ecosystem

Grants Program: Treasury-funded grants for:

- DApp development
- Infrastructure tools
- Educational content
- Community projects

Hackathons: Regular coding competitions to foster innovation.

Incubator: Support for startups building on PezkuwiChain.

Documentation: Comprehensive guides, tutorials, and API references.

15. Legal & Compliance

PezkuwiChain is committed to operating in a responsible and compliant manner while maintaining the principles of decentralization and sovereignty.

15.1. Licensing

The project operates under the **Kurdistan Talent Institute License**, an open and permissive license that encourages innovation and collaboration. The codebase is open-source, allowing for community auditing and contributions.

15.2. Regulatory Approach

KYC/AML Compliance: The identity-kyc pallet provides optional KYC/AML capabilities for applications that require regulatory compliance (e.g., exchanges, financial services) while preserving privacy for general users.

Securities Compliance: HEZ and PEZ are designed as utility tokens for network operations and governance, not as investment securities. However, the project recognizes that regulatory frameworks vary by jurisdiction and is committed to compliance where operations occur.

Data Protection: The architecture is designed with privacy in mind, allowing users to control their personal data and comply with regulations like GDPR.

15.3. Disclaimer

Investment Risk: This whitepaper is for informational purposes only and does not constitute an offer to sell, a solicitation of an offer to buy, or a recommendation of any security or any other product or service. The PEZ and HEZ tokens are utility tokens designed to be used within the PezkuwiChain ecosystem. They are not intended to be investment vehicles. Potential participants should consult with their legal and financial advisors before engaging with the PezkuwiChain network.

No Guarantees: While PezkuwiChain is designed with security and reliability in mind, no blockchain system can guarantee perfect security or uptime. Users participate at their own risk.

Regulatory Uncertainty: The regulatory landscape for blockchain technology is evolving. Changes in laws or regulations could impact the operation or utility of PezkuwiChain.

Forward-Looking Statements: This whitepaper contains forward-looking statements regarding future development, adoption, and performance. Actual results may differ materially from projections.

16. Conclusion

PezkuwiChain represents a paradigm shift for the Kurdish nation and a significant contribution to blockchain technology through its innovative TNPoS consensus mechanism. By combining a robust technical architecture with a thoughtful economic and social vision, and by integrating social trust into the core consensus layer, PezkuwiChain provides the foundational layer for a new digital state.

Key Achievements:

- **Technical Innovation:** TNPoS consensus integrates social reputation with economic security
- **Economic Sustainability:** Dual-token model balances utility and governance
- **Cultural Alignment:** Custom pallets for identity, governance, and education serve Kurdish needs
- **Global Standards:** Built on Polkadot SDK with interoperability and security

Vision for the Future:

PezkuwiChain aims to become the digital backbone of the Kurdish nation, providing:

- **Financial Inclusion:** Banking the unbanked through DeFi and digital currencies
- **Democratic Participation:** Direct democracy through transparent on-chain governance
- **Educational Advancement:** Verifiable credentials and lifelong learning records

- **Economic Opportunity:** Platform for entrepreneurs and developers to build the future

It is a platform built by the community, for the community, with the ultimate goal of empowering Kurdistan through the transformative power of blockchain technology. As the network grows and matures, it will serve as a model for how blockchain can serve the specific needs of nations and communities, rather than imposing one-size-fits-all solutions.

The journey from concept to mainnet has been marked by rigorous development, community collaboration, and unwavering commitment to the vision of digital sovereignty. With the upcoming mainnet launch, PezkuwiChain will transition from promise to reality, offering the Kurdish people and the world a new paradigm for decentralized digital infrastructure.

17. References

Academic and Technical Papers

1. **Polkadot: Vision for a Heterogeneous Multi-Chain Framework** - Dr. Gavin Wood, 2016. https://polkadot.network/whitepaper/
2. **BABE: Blind Assignment for Blockchain Extension** - Web3 Foundation Research. https://research.web3.foundation/en/latest/polkadot/block-production/Babe.html
3. **GRANDPA: A Byzantine Finality Gadget** - Web3 Foundation Research. https://research.web3.foundation/en/latest/polkadot/finality.html
4. **Nominated Proof-of-Stake (NPoS)** - Web3 Foundation. https://wiki.polkadot.network/docs/learn-npos
5. **XCM: The Cross-Consensus Message Format** - Polkadot Wiki. https://wiki.polkadot.network/docs/learn-xcm
6. **Substrate: A Blockchain Framework for a Multichain Future** - Parity Technologies. https://substrate.io/

Project Resources

1. **PezkuwiChain GitHub Repository** - https://github.com/pezkuwichain/pezkuwi-sdk
2. **pallet-pez-treasury Source Code** - https://github.com/pezkuwichain/pezkuwi-sdk/tree/main/pezkuwi/pallets/pez-treasury
3. **pallet-pez-rewards Source Code** - https://github.com/pezkuwichain/pezkuwi-sdk/tree/main/pezkuwi/pallets/pez-rewards
4. **pallet-trust Source Code** - https://github.com/pezkuwichain/pezkuwi-sdk/tree/main/pezkuwi/pallets/trust

Blockchain Governance and Economics

1. **On-Chain Governance** - Vlad Zamfir, 2017. https://medium.com/@Vlad_Zamfir/against-on-chain-governance-a4ceacd040ca
2. **Tokenomics: The Economics of Cryptocurrencies** - Shermin Voshmgir, 2020.
3. **Decentralized Autonomous Organizations (DAOs)** - Vitalik Buterin, 2014.

Trust and Reputation Systems

1. **The Eigentrust Algorithm for Reputation Management in P2P Networks** - Kamvar et al., 2003.
2. **A Survey of Trust and Reputation Systems for Online Service Provision** - Jøsang et al., 2007.
3. **Blockchain-Based Reputation Systems: A Survey** - Dennis and Owenson, 2016.

Digital Identity

1. **Decentralized Identifiers (DIDs) v1.0** - W3C Recommendation, 2022. https://www.w3.org/TR/did-core/
2. **Verifiable Credentials Data Model** - W3C Recommendation, 2022. https://www.w3.org/TR/vc-data-model/

Additional Documentation

1. **Polkadot SDK Documentation** - https://docs.polkadot.com/develop/parachains/intro-polkadot-sdk/
2. **Rust Programming Language** - https://www.rust-lang.org/

18. Contact & Resources

Official Channels

- **Website:** https://pezkuwichain.io
- **GitHub:** https://github.com/pezkuwichain/pezkuwi-sdk
- **Documentation:** https://docs.pezkuwichain.io
- **Block Explorer:** https://explorer.pezkuwichain.io

Email Contacts

- **General Inquiries:** info@pezkuwichain.io

- **Technical Support:** tech@pezkuwichain.io
- **Partnerships:** partnerships@pezkuwichain.io
- **Government Relations:** tech@kurdistan.gov

Social Media

- **Twitter/X:** @PezkuwiChain
- **Telegram:** t.me/PezkuwiChain
- **Discord:** discord.gg/pezkuwichain
- **Medium:** medium.com/@pezkuwichain

Developer Resources

- **Developer Portal:** https://developers.pezkuwichain.io
- **API Documentation:** https://api.pezkuwichain.io
- **Testnet Faucet:** https://faucet.pezkuwichain.io
- **Grants Program:** https://grants.pezkuwichain.io

Appendix A: Glossary

BABE (Blind Assignment for Blockchain Extension): A block production mechanism that randomly assigns slots to validators for block creation, ensuring censorship resistance and consistent block times.

Block Time: The average time between consecutive blocks on the blockchain. PezkuwiChain targets ~6 seconds.

Clawback: The mechanism by which unclaimed rewards are returned to the incentive pool after the claim period expires.

Consensus: The process by which a distributed network agrees on the current state of the blockchain.

Cumulus: A Polkadot SDK library that enables Substrate chains to become parachains.

Era: A period in the staking system (typically ~24 hours) after which staking rewards are calculated and distributed for HEZ.

Epoch: A longer period (432,000 blocks, ~30 days) used for PEZ reward distribution.

Era Points: Performance metrics earned by validators based on their on-chain activity, used to calculate bonus rewards.

Finality: The guarantee that a block cannot be reverted. GRANDPA provides finality for PezkuwiChain.

FRAME (Framework for Runtime Aggregation of Modularized Entities): A Substrate framework for building blockchain runtimes using modular pallets.

GRANDPA (GHOST-based Recursive ANcestor Deriving Prefix Agreement): A finality gadget that allows validators to agree on the finality of blocks.

Halving: The periodic reduction in token emission rate. PEZ undergoes synthetic halving every 48 months.

HEZ: The native inflationary token of PezkuwiChain, used for staking, transaction fees, and network security.

Libp2p: A modular peer-to-peer networking stack used by Substrate for node communication.

Nominator: A network participant who stakes HEZ tokens to back trusted validators.

NPoS (Nominated Proof-of-Stake): Polkadot's consensus mechanism where nominators elect validators.

Pallet: A modular component in the Substrate runtime that provides specific functionality.

Parachain: A blockchain that connects to a relay chain (like Polkadot) for shared security and interoperability.

Parliamentary NFT: A set of 201 unique NFTs that provide governance rights and bonus rewards to holders.

PEZ: The fixed-supply governance token of PezkuwiChain (5 billion total), used for governance and rewards.

Planck: The smallest unit of HEZ token (1 HEZ = 10^10 Planck).

Runtime: The state transition function of the blockchain, defining how blocks are processed. Compiled to WebAssembly for forkless upgrades.

Slashing: A penalty mechanism where validators (and their nominators) lose staked tokens for misbehavior.

Substrate: The blockchain framework developed by Parity Technologies, used to build PezkuwiChain.

TNPoS (Trust-enhanced Nominated Proof-of-Stake): PezkuwiChain's novel consensus mechanism that integrates trust scores into validator selection and reward distribution.

Trust Score: A reputation metric calculated by pallet-trust based on user behavior, contributions, and interactions.

Unbonding Period: The time (28 days) during which unstaked tokens remain locked before becoming transferable.

Validator: A node that participates in consensus by producing blocks and voting on finality.

Wasm (WebAssembly): A portable binary instruction format used for the PezkuwiChain runtime, enabling forkless upgrades.

welati: The governance pallet for PezkuwiChain. The name means "citizen" in Kurdish.

perwerde: The education and certification pallet. The name means "education" in Kurdish.

XCM (Cross-Consensus Messaging): A messaging format for communication between different consensus systems in the Polkadot ecosystem.

Appendix B: Developer Resources

Getting Started

Node Setup:

Bash

```bash
# Clone the repository
git clone https://github.com/pezkuwichain/pezkuwi-sdk.git
cd pezkuwi-sdk

# Build the node
cargo build --release

# Run a development node
./target/release/pezkuwi-node --dev
```

Connecting to Testnet:

Bash

```bash
# Connect to Beta Testnet
./target/release/pezkuwi-node \
  --chain=beta \
  --name="MyNode" \
  --telemetry-url="wss://telemetry.pezkuwichain.io/submit 0"
```

Pallet Integration Examples

Using pallet-trust:

Rust

```rust
// Get trust score for an account
let trust_score = pallet_trust::Pallet::<T>::get_trust_score(&account_id);

// Build trust relationship
pallet_trust::Pallet::<T>::add_trust(&truster, &trustee, trust_value)?;
```

Using pallet-pez-rewards:

Rust

```rust
// Claim epoch rewards
pallet_pez_rewards::Pallet::<T>::claim_rewards(origin, epoch_id)?;

// Check Parliamentary NFT ownership
let is_holder = pallet_pez_rewards::Pallet::
<T>::is_parliamentary_nft_holder(&account);
```

Using identity-kyc:

Rust

```rust
// Register identity
pallet_identity_kyc::Pallet::<T>::register_identity(
    origin,
    identity_data,
    kyc_level
)?;

// Verify identity
let is_verified = pallet_identity_kyc::Pallet::<T>::is_verified(&account_id);
```

RPC Endpoints

Mainnet RPC:

- `wss://rpc.pezkuwichain.io`
- `https://rpc.pezkuwichain.io`

Testnet RPC:

- `wss://beta-rpc.pezkuwichain.io`
- `https://beta-rpc.pezkuwichain.io`

SDK and Libraries

JavaScript/TypeScript:

Bash

```bash
npm install @pezkuwichain/api
```

TypeScript

```typescript
import { ApiPromise, WsProvider } from '@pezkuwichain/api';

const provider = new WsProvider('wss://rpc.pezkuwichain.io');
const api = await ApiPromise.create({ provider });

// Query trust score
const trustScore = await api.query.trust.trustScores(accountId);
```

Python:

Bash

```bash
pip install pezkuwichain-py
```

Python

```python
from pezkuwichain import PezkuwiChain

chain = PezkuwiChain("wss://rpc.pezkuwichain.io")
trust_score = chain.query.trust.trust_scores(account_id)
```

Testing

Unit Tests:

Bash

```bash
cargo test --package pallet-trust
```

Integration Tests:

Bash

```
cargo test --features runtime-benchmarks
```

Benchmarking:

Bash

```
./target/release/pezkuwi-node benchmark pallet \
  --chain=dev \
  --pallet=pallet_trust \
  --extrinsic='*' \
  --steps=50 \
  --repeat=20
```

Documentation

- **Runtime Docs:** `cargo doc --open`
- **Pallet Specifications:** https://docs.pezkuwichain.io/pallets
- **API Reference:** https://api.pezkuwichain.io/docs
- **Tutorials:** https://developers.pezkuwichain.io/tutorials

Community Support

- **Developer Forum:** https://forum.pezkuwichain.io
- **Stack Overflow:** Tag `pezkuwichain`
- **Discord #developers:** https://discord.gg/pezkuwichain
- **Office Hours:** Weekly developer calls (schedule on website)

Document Version: 2.0

Last Updated: October 21, 2025

Prepared by: Kurdistan Tech Ministry & PezkuwiChain Contributors

---

This whitepaper represents the current vision and technical specifications of PezkuwiChain. As an open-source project under active development, specifications may evolve based on community feedback, security audits, and technological advancements. For the most current information, please refer to the official GitHub repository and documentation.