BITTENSOR

Research Report

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Overview

Overview

Artificial intelligence is making waves as the defining technological breakthrough of this decade. However, centralization remains a major bottleneck, limiting its potential for development and growth. Research shows that OpenAI, Google, and AWS dominate over 80% of the generative AI market. This concentration of power introduces significant risks, including privacy invasion, amplification of biases from a select few, and an overreliance on centralized entities—raising concerns about the long-term implications for society.

In response to these challenges, researchers and developers have sought alternative models that replicate the benefits of AI while ensuring openness, decentralization, and shared ownership. This vision led to the creation of Bittensor.

Founded in 2019 by AI researchers Jacob Steeves and Ala Shaabana, Bittensor is best described as a decentralized incentive network for AI development.

Its mission is to bring together a decentralized network of models previously centralized through a programmable incentive mechanism, fostering an open-source intelligence market that operates efficiently on-chain.

Bittensor draws inspiration from two transformative innovations: the internet, which introduced a globally connected system beyond the control of any single institution, and blockchain, which established a decentralized, immutable ledger resistant to centralized influence.

At its core, Bittensor creates a permissionless, global incentives market where value and intelligence are exchanged among participants.

These participants—subnet creators, validators, and miners— compete to earn rewards based on their contributions. By incentivizing AI models that consistently produce the best outputs, it establishes a self-reinforcing feedback loop that drives continuous improvement..

Financially, Bittensor mirrors Bitcoin in its structural design while adopting a different consensus mechanism. Like Bitcoin, it features a fair launch and fixed supply, distributing its native token, TAO, to participants who contribute substantial value.

It also incorporates a halving mechanism, reducing emissions every four years to maintain scarcity and long-term sustainability. As bitcoin is currently the world's most powerful supercomputer, Bittensor aspires to leverage a similar decentralized incentive structure to build the largest AI-driven computational network.

Since its launch, it has grown rapidly, amassing over 70 subnets and positioning itself as the leader in the decentralized AI sector. The recent Dynamic TAO upgrade on February 15, 2025, has further fueled discussions about the ecosystem's growth trajectory and its role in shaping the future of AI.

Dynamic TAO

Proposed in BIT001, Dynamic TAO (dTAO) marks a major evolution in Bittensor's tokenomics and governance model, shifting towards market-driven valuation for subnets.

A key feature of this upgrade is the introduction of subnet tokens, known as ALPHA, which serve as the native token for each subnet allowing for an efficient valuation system, enabling speculation on the worth of individual subnets.

The need for this upgrade arose due to heavy reliance on validators as gatekeepers who determined the amount of TAO allocated to each subnet. This kind of decision-making gives room for inefficiencies and conflicts of interest which includes:

Scalability limitations: As more subnets were added, validators might struggle to thoroughly evaluate each subnet's contributions.

Since there is incentive for validators to conduct additional analysis, emissions will be distributed to any subnet validators stake most on without priority on how it contributes to Bittensor ecosystem.

Monopolistic behavior: Validators could prioritize subnets they had staked on, directing emissions to those subnets to maximize their own rewards. This disrupted the merit-based reward system, reducing fairness and competition.

Dynamic TAO was designed to eliminate these barriers, creating a transparent and decentralized competitive network where market forces dictate emissions, and resources are allocated based on meritocracy.

The upgrade empowers TAO holders by allowing them to engage in informed speculation on Bittensor subnets, influencing how resources are distributed. Previously, miners performed tasks, validators verify them, and rewards were distributed accordingly. TAO holders could also delegate their tokens to validators, who staked them on specific subnets and provided a fixed 15% APY in return. However, this model often led to biases in reward distribution.

Instead of staking with validators directly, TAO holders can now stake on any subnet of their choice. They have two options: staking on subnet 0, which offers lower emissions with no risk and gradually reduces to zero emissions, or staking on other subnets, which provides the potential for higher emissions but comes with increased risk.

Staking on a subnet is seen as swapping TAO for the subnet's native token (ALPHA), meaning that participants share both the upside and downside of the subnet's performance.

Each subnet has a dedicated liquidity pool consisting of TAO and its ALPHA token, enabling seamless trading within the network.

Although the AMM for trading (staking/unstaking) subnet tokens follows the Uniswap V2 constant product formula, it differs in one key aspect—liquidity cannot be externally added to the pool.

Instead, liquidity comes from subnet emissions, with 50% of newly issued subnet tokens automatically acting as liquidity.

The remaining 50% of newly issued subnet tokens is distributed among subnet creators, validators, and miners, ensuring continuous incentives within the network.

Changes in Emissions

Previously, emissions were determined by validators on the Root network, but Dynamic TAO transfers this power to TAO holders. By leveraging Yuma Consensus V2, TAO holders collectively determine how newly issued TAO is allocated across subnets based on the relative price of each subnet's ALPHA token, ensuring that higher-performing subnets receive greater emissions.

This mechanism creates a self-reinforcing cycle, where the best- performing subnets attract more stakers, driving up the price of their ALPHA token and sustaining the flywheel effect.

To prevent manipulation of ALPHA token prices and exploitation of emissions, Dynamic TAO implements several safeguards such as:

Slippage costs dynamically increase based on how a trade (staking/unstaking) impacts the TAO-to-subnet token ratio in the liquidity pool, discouraging excessive price influence. Additionally, Random Order Finalization (ROF) ensures that transactions are executed in a randomized sequence rather than sequentially, making it impossible to predict slippage and exploit the system.

Workflow

How Does Bittensor Work?

Bittensor is built on a three-layer architecture, where each layer plays a crucial role in maintaining the ecosystem.
These layers are Subnetworks, the Blockchain Layer, and the Bittensor API.

Subnetworks (known as subnets)

Subnets serve as incentive-based competitive marketplaces that produce digital commodities. The best way to see a subnet is as an AI experiment where participants—miners and validators— contribute resources and are rewarded based on their impact. Each subnet operates using a scoring model, known as the incentive mechanism, which defines tasks for miners and establishes how validators evaluate those tasks.

A subnet consists of 256 neuron (node) slots, with 64 slots reserved for validators and 192 slots for miners. Emissions in each subnet depend on the relative price of its native ALPHA token, with TAO flowing into subnets accordingly.

Subnet tokens follow a halving schedule similar to Bittensor’s, ensuring a structured supply reduction over time. Currently, Bittensor hosts over 70 active subnets, each fostering different forms of AI development.

Miners:

Miners are users who contribute computing power and resources to solve the tasks defined by a subnet.

Mining in Bittensor is highly competitive, as multiple miners within a subnet attempt to solve the same task, competing for ranking positions.

Each miner deploys their best-performing node to rank higher on the leaderboard, determined by validators evaluating the quality of their output. The longer a miner remains active and consistently delivers high-quality results, the more profitable they become.

Miners with the lowest scores are eventually deregistered from the network. However, anyone can participate in mining as long as there are open slots, and miners can register different nodes in multiple subnets. Hardware and software requirements vary per subnet, and a miner must stake TAO to register a UID on a given subnet.

Validators:

Validators are responsible for consensus production and output verification within Bittensor.

Their main roles includes validating miner outputs by assigning weight scores to responses, which are then sent to Yuma Consensus to determine rewards and acting as a gateway for users and applications interacting with subnets, forwarding queries to the appropriate miners.

To become a validator, an individual must possess or have delegated a minimum of 5,000 to 20,000 TAO to acquire vPermit for the subnet they wish to validate.

Previously, validators also controlled emission distribution, but this changed with the Dynamic TAO upgrade. Now, emissions to validators are determined based on their stake and how well their weight scores align with the broader consensus of other validators (vTrust values).

As of now, over 200 validators are registered on Bittensor, with Corcel leading at 13.8% dominance, according to Taostats.

Subnet Creators:

Subnet creators are individuals or teams that launch and maintain a subnet, designing its scoring model and rewarding participants accordingly.

Each subnet follows three development stages which are; running the subnet locally, running it on testnet and then launching on mainnet.

To register a subnet, creators must lock a specific amount of TAO, which fluctuates based on subnet demand. Currently, this requirement stands at 566.82 TAO, but during periods of high demand, it has surged beyond 6,000 TAO. This trend suggests that as Bittensor grows, the cost of launching subnets may continue to rise.

Stakers:

Stakers are TAO holders who participate in the network by delegating their stake to validators. There are currently two staking pathways on Bittensor..

The first is delegating to validators in non-subnet 0 subnets, which involves exchanging TAO for subnet tokens, exposing stakers to potentially higher returns but also increased volatility while the second is delegating to validators on subnet 0, where staked TAO remains as TAO and generates lower but more stable emissions..

Currently, over 70% of TAO is staked, and with Dynamic TAO, stakers must conduct more in-depth research to ensure they are staking in profitable subnets.

Blockchain Layer

Bittensor was originally built as a Polkadot Substrate-based blockchain by the Opentensor Foundation. It serves as the ledger for recording transactions, balances, and activities of miners, validators, and subnet creators. It also allows TAO holders to stake and track their balances.

A critical component of Bittensor’s blockchain is Yuma Consensus, which plays a fundamental role in reward distribution.

Yuma Consensus

Yuma Consensus aggregates subnet scores to determine incentive distribution, ensuring rewards are allocated based on performance and consensus alignment. It benchmarks validator-submitted weight scores to reward miners and validators while evaluating validator trustworthiness by comparing their scores. Those deviating significantly from the consensus receive reduced rewards.

To maintain accuracy, Yuma Consensus uses Clipping, a mechanism that penalizes validators for inaccurate miner evaluations by withholding rewards, reinforcing a fair and merit-based system

Bittensor API

The Bittensor API acts as the communication bridge between the blockchain and all subnets. It allows developers to build applications that interact with subnets and utilize their services.

Bittensor Subnets

Bittensor subnets are specialized units within the ecosystem that coordinate network participants to solve specific tasks. Currently, there are 71 subnets on mainnet, 20 on testnet, and more are expected as the ecosystem expands.

Each subnet is deemed valuable by the amount of TAO emissions it accrues which further affects their ALPHA token as staking (buying subnet tokens) increases.

Some of the subnets with top emissions includes:

ChutesAI (SN 64)

Chutes AI is building a serverless compute platform that enables users to deploy and run and scale any AI model swiftly and efficiently founded by Rayon Labs.

Simply put, it is a cloud for AI models which doesn't rely on big company server but a network GPU providers on Bittensor.

Since its launch in December 2021, ChutesAI is hosting over 50 models and processing more than 5 billion tokens daily.The subnet has a 13.44% daily TAO emission rate (967.58 TAO/day) and a market cap of $14.08 million.

Targon (SN 4)

Targon is a redundant determined verification system for inference verification used to interpret and analyze ground truth with sources and query founded by Manifold.

In simple terms, it acts as a trust mechanism for verifying AI generated output by comparing responses against reliable known sources (ground truth data) using a distributed network.

Targon processes over 2 billion tokens daily (more than 400 tokens/second) with 13.13% daily emissions (945.58 TAO/day) and a market cap of $13.24 million.

It powers applications such as the Umagi DePin network, DippyAI, Penn blockchain, Sybil AI, and TaoBot. Targon and ChutesAI have followed a similar growth pattern since January.

Proprietary Trading Network (SN 10)

Developed by Taoshi, PTN is a decentralized platform that aggregates trading signals from quantitative and deep learning systems, offering comprehensive signals across various asset classes, including crypto and Forex.

The PTN subnet has been one of the fastest-growing subnets, surging from 0% emissions in early February to reaching a peak of 13.98% emissions, securing its place in the top 3.

With a 12.58% daily emission (905.50 TAO/day) and a market cap of $12.52 million, PTN powers Glitch Financial (beta launching soon) and Timeless, a multi-functional auto-trading platform.

It also integrates with MetaTrader 5 for Forex strategies and is building a connector for Hyperliquid. A portion of its revenue is used to purchase Theta tokens for DAO initiatives and ecosystem growth.

Bitmind (SN 34)

Bitmind is a decentralized network on Bittensor, specifically designed to detect AI-generated content, such as deepfakes.

As AI-generated media continues to rise, real-time verification tools are becoming essential. To address this, Bitmind leverages Bittensor to create an accurate detection system for synthetic media.

Recently, Bitmind announced the release of its video detection beta browser extension and web app, both focused on deepfake detection for videos. In addition, its suite of APIs provides users with access to various other subnets, including SN1, SN4, SN9, SN20, and SN22.

With a market cap of $6.97 million and daily emissions of 6.82% (490.84 TAO/day), Bitmind's subnet supports several applications, including the web app, the Agent Suite Chrome extension, and TaoBot.

Compute Network (SN 51)

The Compute Network is a community focused on providing decentralized computational power, acting as a GPU rental market within the Bittensor network.

It allows users to rent GPU resources from miners, with all transactions and rewards managed by Bittensor, ensuring a peer- to-peer exchange of computing power. This system operates similarly to platforms like Render, but with added incentives and enhanced transparency.

The network has a market cap of $6.35 million, with a 5.87% daily emission rate (422.31 TAO/day).

NineteenAI (SN 19)

NineteenAI is focused on providing lightning-fast decentralized inference, leveraging a curated selection of high-quality, state-of-the-art (SOTA) text and image models. Its API is free and offers low latency, powering DeAI applications such as Corcel and Glider.

With a market cap of $4.27 million and daily emissions of 4.17% (300.18 TAO/day), NineteenAI is making a significant impact. The subnet also integrates with applications like Make it a Quote and TaoBot.

Nova (SN 68)

Nova is a global decentralized engine revolutionizing drug discovery by transforming pharmaceutical R&D into a high-speed, merit-based competition. It incentivizes AI and heuristic innovations, encouraging researchers to refine models and heuristics while unlocking new opportunities.

Within four days of launch, Nova's token made consistent ATHs, with miners and validators earning 90 TAO/day. Nova's goal is to accelerate the development of novel therapeutics from extensive chemical databases.

Nova has a market cap of $1.64 million and daily emissions of 3.34% (240.37 TAO/day).

Sturdy (SN 19)

Sturdy is a subnet designed to lead DeFAI by optimizing DeFi yield strategies through DeAI.

Miners compete to generate the best allocations for users' liquidity across DeFi, while validators evaluate the returns from each miner's allocations to assign weight.

For users, Sturdy abstracts every step, allowing them to simply deposit into any aggregator or silo of their choice to earn yield.

Currently, Sturdy features 8 aggregators and 30+ silos, with a total volume of over $200 million allocated.

The subnet has a market cap of $2.79 million and daily emissions of 2.55% (183.63 TAO/day). Sturdy's contributors also built Taofi, the financial layer for decentralized AI.

Apex (SN 1)

Built by Microcosmos alongside other subnets like SN 9, 13, 25, and 37, Apex specializes in natural language processing tasks.

Miners perform tasks using generative text completion for chat prompts, with one of its distinguishing features being a model that incorporates multi-step reasoning (COT).

Apex has a market cap of $4.2 million and daily emissions of 2.29% (164.56 TAO/day).

Templar (SN 3)

Templar represents a groundbreaking shift within the Bittensor ecosystem, enabling permissionless, incentivized peer-to-peer decentralized AI model training, a task traditionally dominated by centralized institutions.

Founded by Samuel Dave, former blockchain lead at OpenTensor, Templar is currently training a 1.2 billion parameter model. While the model's details are limited, it uses fewer parameters than those of Nous Research and Prime Intellect.

The market cap stands at $2.64 million with 2.11% emissions (152.09 TAO/day).

Gradient (SN 56)

Gradient is a zero-click training platform for decentralized AI model training, founded by Rayon AI Labs.

It has already trained 18 million parameters, surpassing the capabilities of Google and Together A

Its market cap is $1.7 million, with emissions at 1.75% (125.79 TAO/day). Image training is currently in beta..

Key Metrics

Data Recorded on 12th January

Price: $285.91

Market Cap: $2.4B

FDV: $6B

ATH: $757.60

Total Supply: 21M

Maximum Supply: 21M

Down From ATH: -62.3%

Circulating Supply: 8.45M (42.8%)

Total TAO Holders: 12.9K

Trading Volume: $6.11B

Total TAO Staked: $6.11B

TA Staked Value: $1.7B

Tokenomics

Token Utility

At the core of Bittensor lies the TAO token, which serves multiple functions: governance, incentivization, access, and fees.

TAO shares many similarities with Bitcoin, including a fair launch, a total supply cap of 21 million, halving schedules, and the introduction of tokens into circulation through mining activities.

Subnet creators, miners and validators are required to lock TAO to participate in the network, which increases demand. Token holders can also stake their TAO with any validator of their choice within the subnets and vote on governance proposals.

Additionally, users of the Bittensor network or applications built on top of it use TAO to pay for services and fees.

Demand Drivers

Bittensor is a network that tokenizes intelligence, meaning the demand for intelligence directly correlates with an increased demand for usage and participation..

One of the primary drivers of demand is the expansion of subnets. Since 2024, subnets have grown by 118%, and the latest dynamic TAO upgrade is expected to draw even more attention.

Moreover, as more applications are built on top of Bittensor subnets, the demand for TAO will soar, as users will need it to access services and pay for fees.

Business Model

100% of TAO emissions are directed into subnet liquidity pools, distributed based on the value each subnet contributes to the ecosystem. Miners, validators, and subnet creators receive subnet alpha tokens from these pools, which can then be swapped for TAO (subject to slippage).

Stakers who delegate their TAO to validators also receive a portion of alpha token emissions as rewards.

Value Capture

There is significant value capture for stakers, who can participate in the ecosystem as subnet creators, miners, delegators, and validators.

However, the requirements for hardware, expertise, and tokens vary depending on the role, with delegating having the lowest barrier to entry.

Token Supply

The total supply of TAO is capped at 21 million, with 40.25% currently in circulation. Of the circulating supply, 72.31% is delegated or staked on the network to earn rewards, while only 27.37% is free.

The current annual inflation rate stands at 12.51%, which decreases every four years or after every 10.5 million blocks via halving. The first halving is scheduled for December 2025, which will reduce the block reward to 0.5 TAO/block, decreasing the annual inflation rate to 6.26%.

Key Stats

Key Stats

Overview

Total miners: 11K+
Emissions (30D): 216K
Total Accounts: 211.9K

Active Validators: 250+
Total Subnets: 71
Total Subnets Value: 1.74TAO ($445.45)

Source: Taostats

Findings

- The total subnet value skyrocketed to 4.23 TAO on March 3rd following the Dynamic TAO launch.
- Since 2024, the number of subnets has grown by 118.18%, aligning with the increasing demand for various intelligence commodities.
- Over 6 million TAO tokens, approximately 72.31% of circulating TAO, are currently staked across all subnets.
- The number of accounts registering on the Bittensor network has grown by over 25% since January.

Competitive Analysis

Competitive Analysis

Metrics	Bittensor	Akash	Render
Total Accounts	211.9K	788K	Nil
Total Validators	250+	100	Nil
Business Model	Miners solve users' tasks to earn rewards, while validators ensure that miners are performing their duties correctly to be rewarded also.	It connects individuals with idle computing power to those in need through a marketplace built on the Akash blockchain sharing rewards accordingly.	It focuses on GPU renting, allowing users with idle GPUs to rent them out to those in need through its network, while earning rewards for their contributions.
Unique Offering	A coordination layer for intelligence, where network participants collaborate to drive the advancement of AI development.	Built as a marketplace for computing resources such as CPUs and GPUs, leveraging its own blockchain to maintain the platform.	The sole focus is on GPU renting across various institutions.
Emissions	1 TAO/block. Approximately 12.51% annually with halving every 4 years	6.59 tokens/block. Approximately 8-13% annually.	Operates on a monthly epoch system based on the BME Model.
% Token Staked	**72.58**	**43.5**	**Nil**

Milestones

Milestones

- Bittensor stands out as the flagbearer for decentralized AI, both in market capitalization and mindshare.
- Developed the innovative Yuma consensus mechanism, a hybrid of POW and POS, designed for fuzzy consensus and reward distribution.
- Recognized as the largest coordination layer for AI models in crypto, with over 4,000 models.
- Recently launched the Dynamic TAO upgrade, further enhancing the democratization of the network..

Future

Future

- Expansion of subnets is a major catalyst, providing room for more intelligence to be built on top of Bittensor and accelerating the possibilities for users within the ecosystem. There are expectations to increase this to 1,028 subnets, making Bittensor highly competitive.

- With Dynamic TAO introducing subnet tokens, there are speculations that this could trigger a similar surge to AI agents on virtual protocols, driving massive attention to the Bittensor ecosystem.

- The first halving is scheduled for December 2025, which will reduce inflation through block rewards. This could either increase competition among miners and validators or lead to apathy if the cost of contributing (fine-tuning models by miners and running validation software) is lower than the rewards.

- As subnet registrations grow, tracking emissions, performance, and opportunities will become overwhelming, making AI-powered analytics essential. A key protocol to watch will be one that can handle this, similar to what Cookiefun did for AI agents.

Conclusion

Conclusion

One of the most significant challenges artificial intelligence may face in the future is centralization. If this technology falls into the hands of a few, society becomes vulnerable to their ambitions and biases.

Bittensor aims to combat this by building a decentralized marketplace that tokenizes intelligence, ushering in a new era of decentralized artificial intelligence.

Positioned at the crossroads of blockchain and AI, Bittensor is not just advancing the potential of decentralized intelligence but also contributing to the broader Web3 ecosystem.

In addition to decentralization, Bittensor also offers incentivization, creating a flywheel effect that attracts market participants and accelerates the development of the intelligence layer.

With the rise of subnets and the Dynamic TAO upgrade, Bittensor is poised to revolutionize the AI space, much like DeFi has transformed the financial system.

As the network continues to grow and adapt, Bittensor’s decentralized AI ecosystem offers unlimited potential.

The future looks bright, and as these technologies evolve, Bittensor could play a pivotal role in reshaping the landscape of AI for the benefit of a more open, inclusive world.

End of Report

End of Report

Date of Report: 07th March 2025

Disclaimer: The information contained in this report is based on data available up to 7th March 2025. It is intended for informational purposes only and should not be considered as financial or investment advice. Readers are encouraged to conduct their own research and seek professional advice before making any investment decisions.

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Note: The information in this report is subject to change as the crypto market and Blockchains continue to evolve. We encourage readers to stay updated with the latest developments and market trends.

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