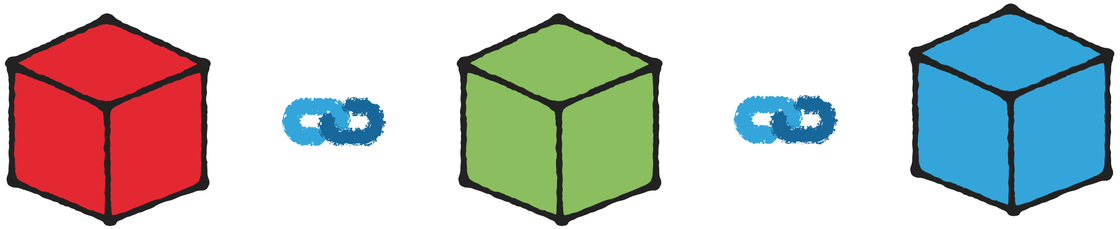

# Decentralized Governance


Johnnatan Messias, PhD

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MAX PLANCK INSTITUTE
FOR SOFTWARE SYSTEMS


October 16th, 2025

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# Who Am I?

### Computer Scientist

- Bachelor (UFOP), Master (UFMG), and PhD (MPI-SWS) in Computer Science

### Vast academic experience

- UFOP, UFMG, ELTE, MPI-SWS, and good publication record.

### Vast industrial experience

- Kunumi, Chainlink Labs, Matter Labs

### Taught and organized classes and seminars

- EEDS, UFOP, UFMG, UdS/MPI-SWS, received award nominations.

# Socially disruptive technologies

## Research interests

### Social Computing

- Vast topics of interest, publications.

### Machine Learning

- Most innovative ML health software in Brazil by IT Forum 365, promoted by PwC and ITMidia.

### Decentralized technologies

- Vast topics of interests, talks, papers.

# Decentralized Technologies — Blockchains

## Decentralized Governance 📦

- Fairness in Token Delegation: Mitigating Voting Power Concentration in DAOs (under submission)
- **Understanding Blockchain Governance:** Analyzing Decentralized Voting to Amend DeFi Smart Contracts (under submission)
- On the Centralisation of Governance Power in Decentralized Autonomous Organizations (under submission)

## Airdrops 💦

- Airdrops: Giving Money Away Is Harder Than It Seems (under submission)
- Crypto Airdrops and Finance in Digital Cultures: From Speculation to Sociality (under submission)

## Data 💽

- A Public Dataset For the ZKsync Rollup (FC-CAAW25)
- The Writing is on the Wall: Analyzing the Boom of Inscriptions and its Impact on EVM-compatible Blockchains (FC-CAAW25)

## DeFi / MEV 🏎️

- The Express Lane to Spam and Centralization: An Empirical Analysis of Arbitrum's Timeboost (under submission)
- Liquid Staking Tokens in Automated Market Makers (Marble 24)
- Cross-Rollup MEV: Non-Atomic Arbitrage Across L2 Blockchains (ArXiv24)
- Quantifying Arbitrage in Automated Market Makers: An Empirical Study of Ethereum ZK Rollups (Marble 24)
- Cross-border Exchange of CBDCs using Layer-2 Blockchain (CfC 24)
- Dissecting Bitcoin and Ethereum Transactions: On the Lack of Transaction Contention and Prioritization Transparency in Blockchains (FC 23)
- Selfish & Opaque Transaction Ordering in the Bitcoin Blockchain: The Case for Chain Neutrality (IMC 21)

## ZK 🔐

- Unrolling the Performance of ZK-Rollups through Stochastic Modeling (IEEE SMC 25)

## And more 🔮

# What Is a Decentralized Autonomous Organization (DAO)?

## Decentralized Governance

- **Decision-making** authority is **distributed among members** instead of being concentrated in a central entity.
- **Benefits:** Increased inclusivity, resistance to centralized power abuse, and enhanced resilience.

## Transparency

- Operations, decisions, and treasury **management are recorded on a blockchain, visible to all members** and stakeholders.
- **Benefits:** Builds trust and accountability within the community.

## Smart Contract Automation

- **Rules and operations** of the DAO **are encoded in smart contracts**, enabling autonomous execution of tasks **without intermediaries**.
- **Benefits:** Efficiency, reliability, and reduced risk of human error.


## Token-Based Membership and Voting

- **Members hold** tokens that represent **voting power** or rights within the DAO. Governance **often** operates **on principles like one-token-one-vote** or quadratic voting.
- **Benefits:** Aligns incentives, fosters active participation, and enables scalable governance.

## Community-Driven Purpose

- DAOs are **typically mission-oriented**, focusing on goals such as funding projects, managing decentralized protocols, or creating shared value for members.
- **Benefits:** Engages a global, like-minded community united by a common vision.

# What Are the Key Characteristics?

### Token ownership

- It represents a **stake in the system**, allowing participation in decision-making.

### Token delegation

- It enables holders to transfer **voting power to trusted representatives**, similar to liquid democracy.


### Who can vote?

- Anyone with governance **(delegated) tokens can vote** on proposals via secure blockchain platforms.

### On-chain vs off-chain voting

- On-chain voting ensures **transparency and immutability**.
- Off-chain voting is **faster** but less transparent.

### Most typical voting systems

- Majority voting and quadratic voting.
- Locking tokens.
- Continuous voting.
- Fixed or dynamic quorum.

# DAO LANDSCAPE


Curated by @Coo

## DAO Operating Systems

ARAGON
MolochDAO
COLONY
Orca Protocol

## Investment DAOs

MetaCartel Ventures
theLAO
Flamingo
GCR
Komorebi
Duck DAO
UdacityFund

## Collector DAOs

PleasrDAO
FlamingoDAO
Gremlins
FingerprintsDAO
BRRDAO
herstoryDAO
MUSE0DAO
Whale

## Protocol DAOs

MAKER
Compound
UNISWAP
AAVE
Yearn
SYNTHETIX
Index Coop
PieDAO
LIDO
Sushi
Curve
pool together
tornado
KeeperDAO
Badger
hDAO
RaribleDAO

## Service DAOs

RAID GUILD
DXdao
PartyDAO
MetaFactory
Fire Eyes
Reverie
NeptuneDAO
LexDAO
MetaverseDAO
Llama

## Social DAOs

FWB
Seed Club
GITCOIN
FiatLuxDAO
Metafam
KrausHaus
Bright Moments
SquiggleDAO
ProsperDAO

## Media DAOs

BanklessDAO
FOREFRONT
GCR
DarkstarDAO

# Case Study: Compound and Uniswap

### Characterize governance protocols

- They are **active and regularly used**, with a steady flow of proposals.
- The majority of the **proposals receive significant support**.

### Analysis of token concentration

- A small group of **10 voters holds a significant voting power**.
- **Proposals** only **required** an avg. of **3—5 voters to obtain at least 50% of the votes**.


### Analysis voting cost

- We reveal a **huge variation in voting costs**.
- **Voting costs can be unfairly expensive for small token holders**, which has fairness implications for the decision-making process.

### Voting pattern of voters

- We discover **potential voting coalitions** among the top voters in Compound UNISWAP
- This could exacerbate concerns of **voting concentration**.

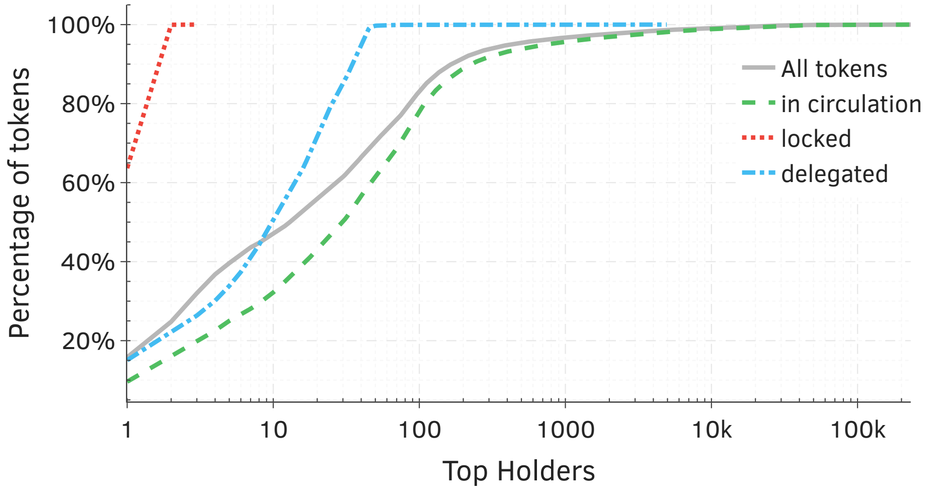
Compound

UNISWAP

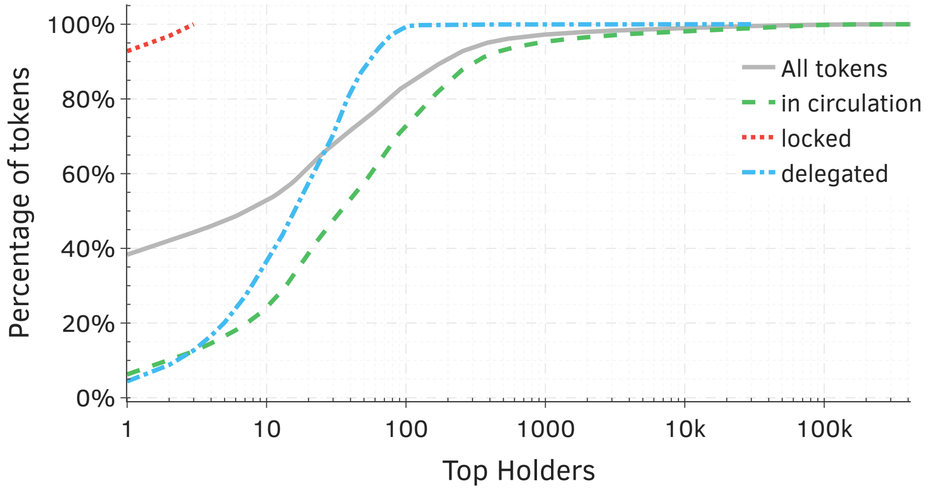
- It leads to real-world consequences.
  - Smaller voices are drowned out.
  - Participation might decrease.
  - Open doors for vulnerabilities.

Understanding Blockchain Governance: Analyzing Decentralized Voting to Amend DeFi Smart Contracts – arxiv.org/abs/2305.17655

# The Problem of Governance Token Concentration




Compound




UNISWAP

## Users actively vote on proposals

- **88.63% in favor**, on average.

## Voting costs vary significantly

- From $0.03 to $294.02, detrimental to small token holders with an **average cost of $6.82 per vote**.
- **Normalized costs per vote** unit reveal an average of **$598.97**, posing fairness concerns.

## Voting power is concentrated

- **10 voters holding 50.53% and 35.73%** of all tokens for **Compound and Uniswap**, respectively.
- On average, **proposals only required 3—5 voters to pass**.

## Powerful voters potentially form coalitions

- It raises concerns about **voting concentration**.

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# How Does Delegation Typically Work Today?

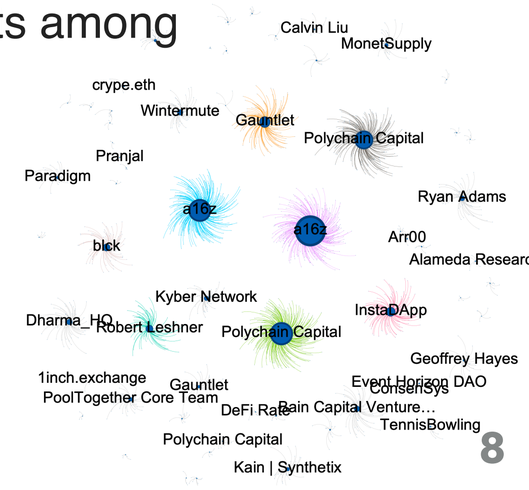
- **DAO vs. Traditional Elections:** Unlike traditional systems (nationality-based voting power), DAOs require active delegation of voting power (to self or others).

- **Key Question:** **Amongst all participants, who should token holders choose as their delegate?**

- **Platform Influence:** Dashboards displaying DAO information (delegated tokens, voting records) can inadvertently bias choices towards highly-ranked participants.

- **Consequence:** Potential "*rich get richer*" dynamic, concentrating power and undermining decentralization.

- **User Challenge:** Difficult for token holders to identify delegates truly aligned with their interests among numerous options.



# Tally: a Platform Designed To Support DAOs

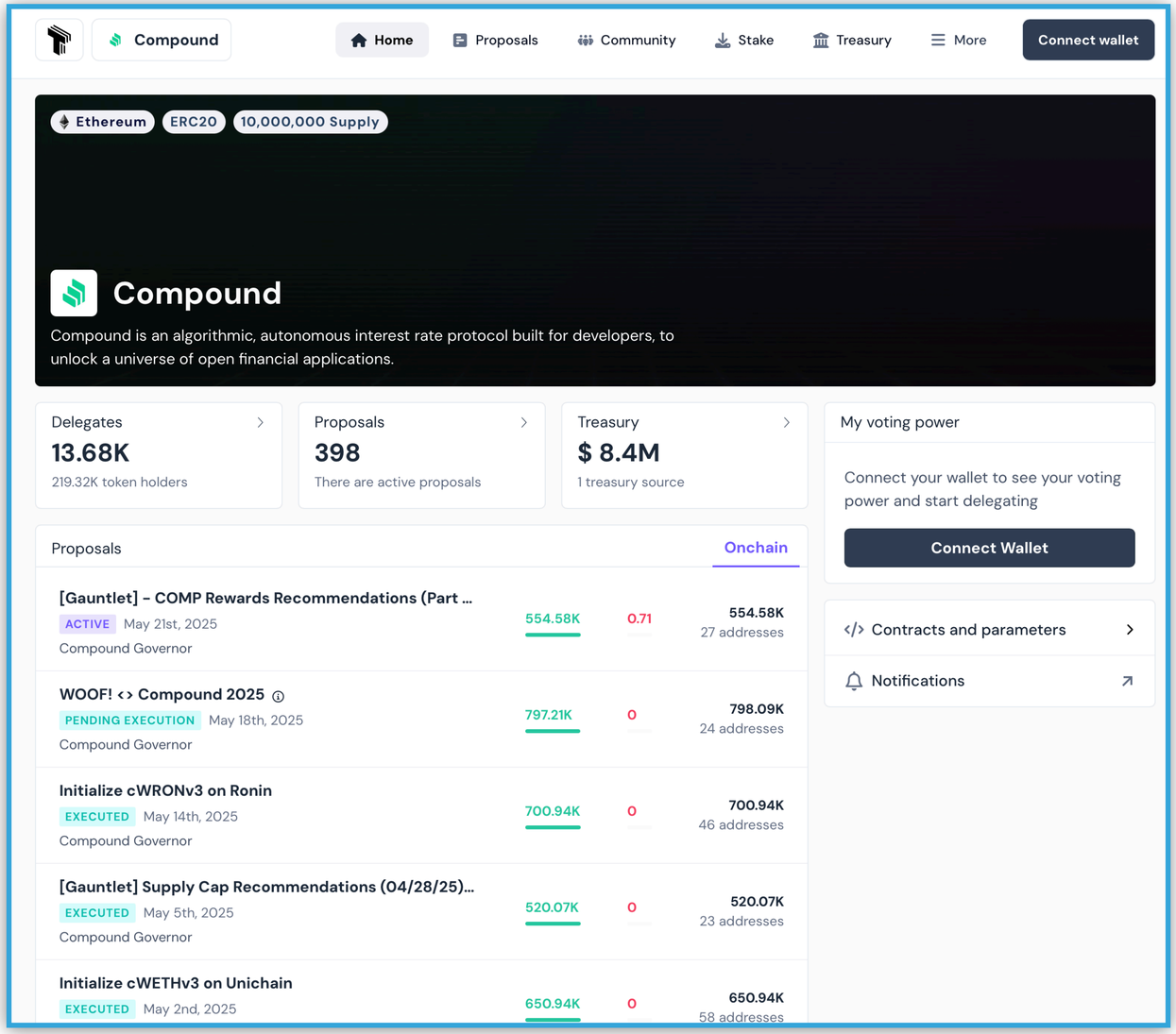
## Key Features of Tally 🍀

- **Token Launch:** It provides tools for deploying tokens, ensuring scalable distribution and seamless integration with EVM chains.

- **Governance Management:** It enables on-chain proposal creation, voting, and execution. It supports frameworks like OpenZeppelin Governor and offers features such as delegate registration and transparent voting power management.

- **Staking Solutions:** Its staking system allows protocols to distribute fees to token stakers, aligning economic incentives between protocol usage and token holder rewards. It supports features like liquid staking tokens (LSTs) and integrates with restaking protocols.

- **Tally Protocol:** It introduces a liquidity layer for governance tokens, enabling token holders to earn staking rewards while maintaining voting rights.

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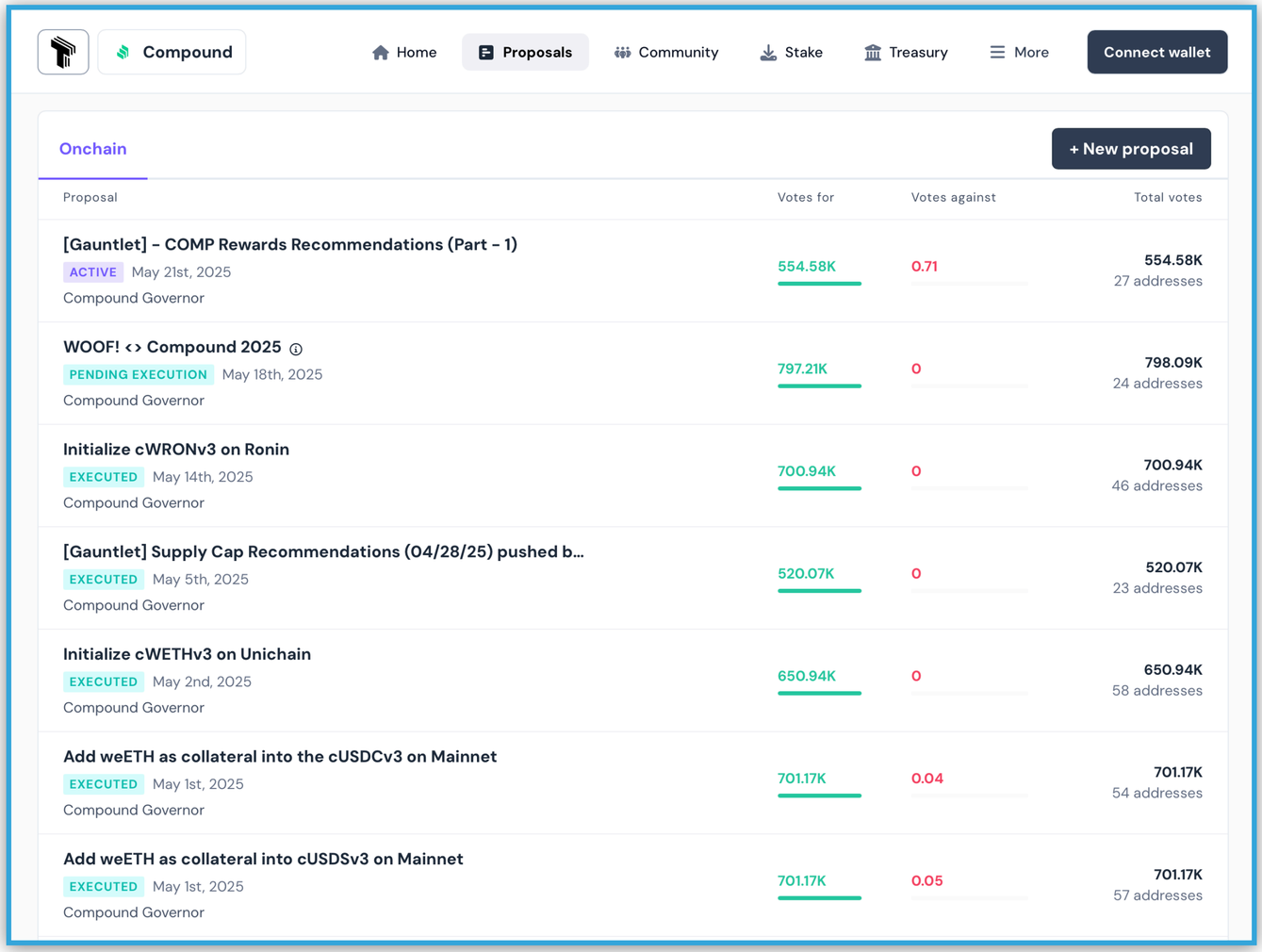


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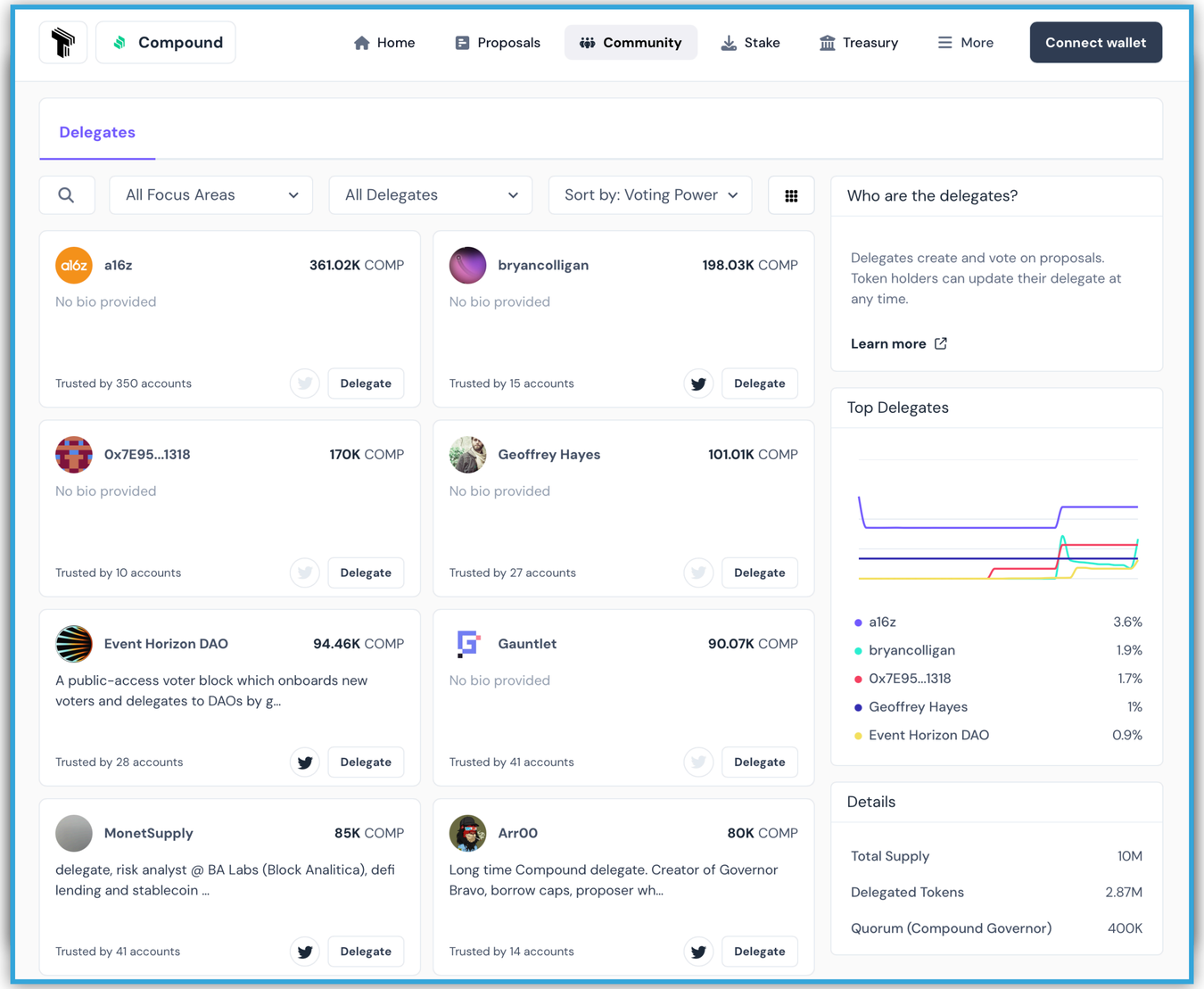


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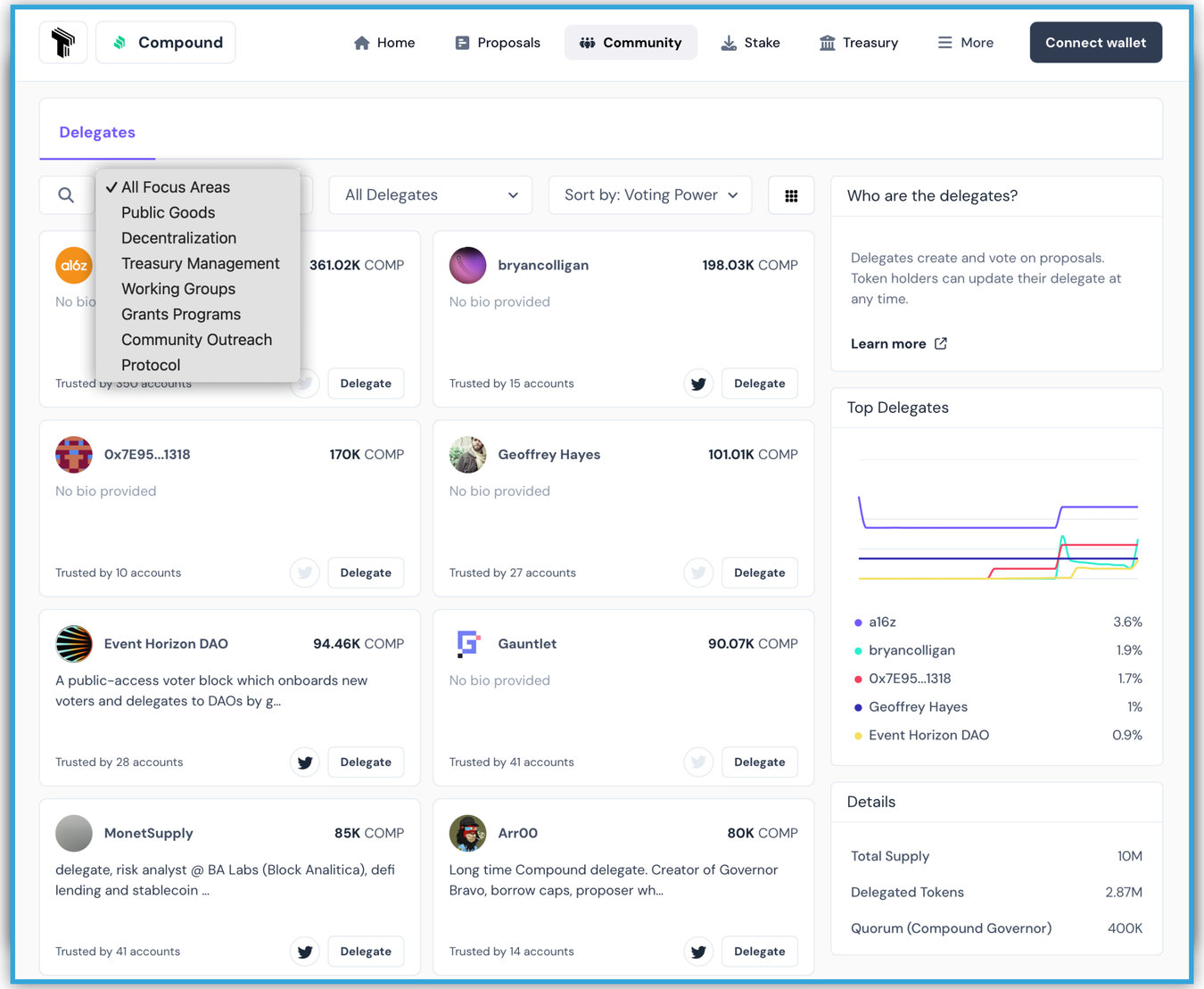


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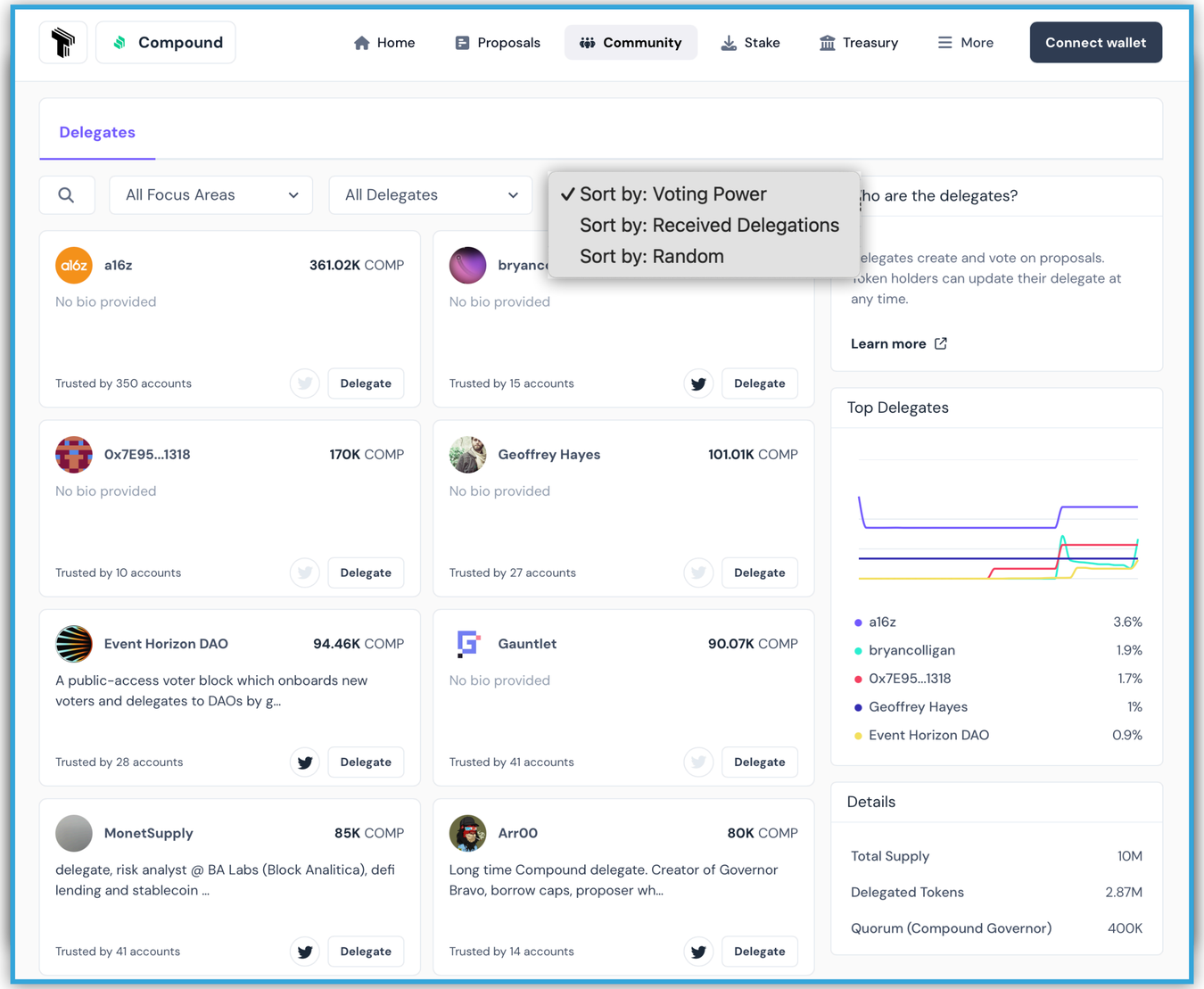


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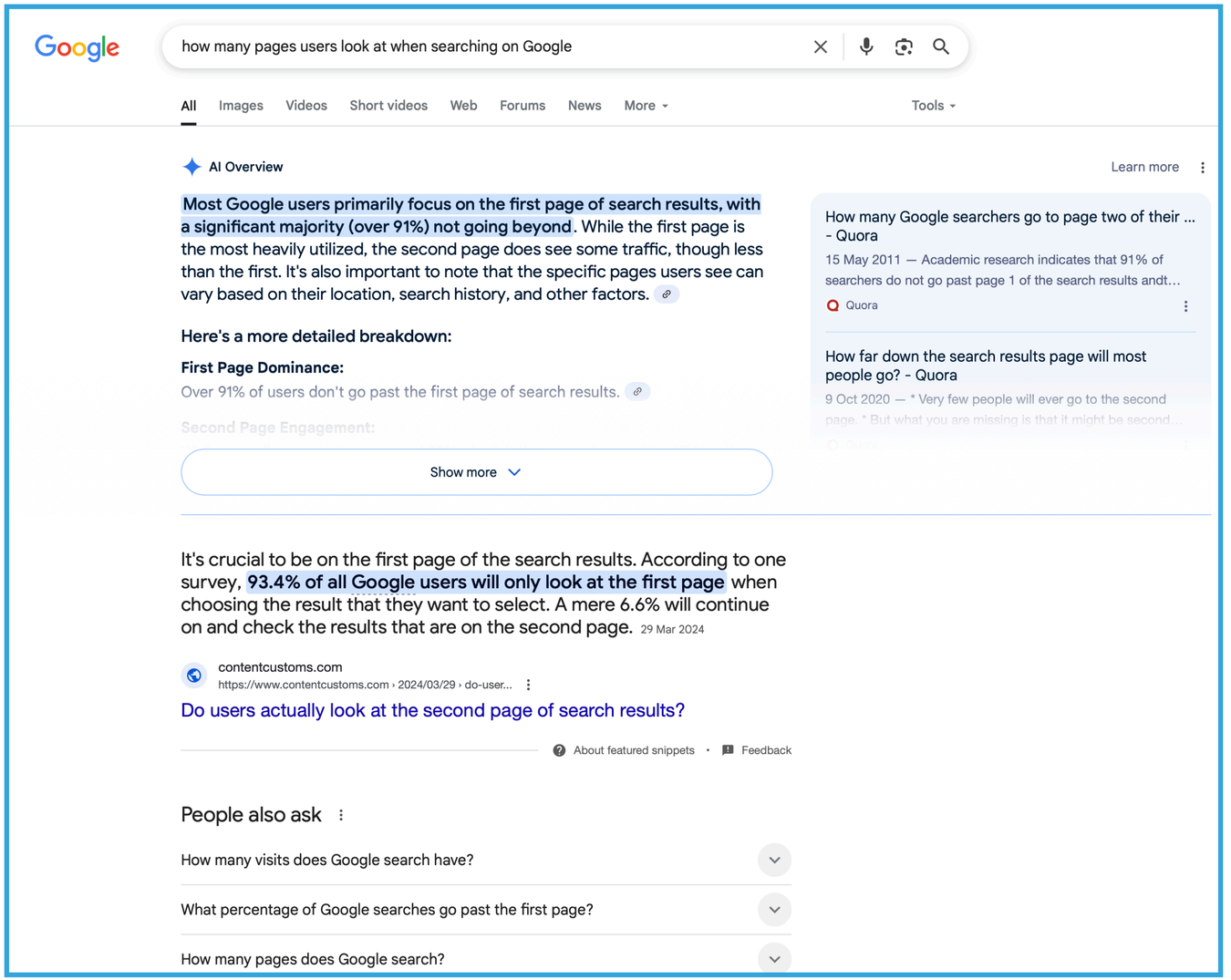
# Ranking Order Can Influence User Choices




Marketing Research Survey: Google Search Behaviors — https://www.teknicks.com/blog/marketing-research-survey-google-search-behaviors

# What Can We Do About It? 🤔

# A Proactive Solution: Interest-Aligned Delegation Matching

- **Address a critical challenge in DAO governance:** Optimizing delegation matching!
- **Like in traditional democracy:** voters vote for a politician when they have their interested aligned.

**Why not do the same with token delegation in DAOs?**

- **Goal:** Provide governance systems with tools to:
  Users delegate to voters who are better aligned with their interests.

  Reduce delegation bias.

  Improve transparency of voting power distribution.
- **Example:** A "*Delegation Advisory*" system, similar to voting advisories in democratic elections.
- **Enhanced Decision-Making:** Lead to more secure, decentralized, and effective DAO governance.

# Roadmap

## Data Acquisition

- On-chain data (Ethereum & other archive nodes).
- Text-based data: Off-chain discussions (Forums, Discord).
- Other relevant data platforms (e.g., Nansen, Messari, Tally).

## Voting Behavior Analysis

- Analyze how voters engage on proposal discussions.
- Extract topics of interested for each voter.
- Publish results in an academic paper.

## Implement Delegation Matching Algorithm

- Design and build a MVP of delegation matching system.
- Implement a simulation environment framework to test the system.

## Test and Evaluate

- Deploy the matching algorithm by partnering with delegation platforms / DAO projects.
- Evaluate the performance via A/B testing and/or simulations.


ethereum

ARBITRUM

OPTIMISM

zkSync era

# How can we improve DAOs?

- What metrics can accurately quantify the level of decentralization in a DAO?
- How to provide incentives for people to vote?
  - Can they game the system? If there is a chance they will.
- How to avoid/mitigate voting buying, intimidations, or coercion?
- How can DAOs achieve privacy for their participants while maintaining some form of transparency?
- How can DAOs leverage emerging technologies (e.g., multi-chain) for better scalability and security?
- How can we rigorously analyze and verify DAO governance models?
  - How can we automate testing and experimentation in DAOs?
- How can we design user-friendly interfaces for DAO participants?

# Contact

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