

Design & Simulation of Voting Influence Methods

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Which voting system balances influence?

Problem: Blockchain DAOs, including Catalyst, are governed by one coin - one vote policy which is susceptible to oligarchic control.

Solution: Design and simulate voting algorithms that increase the diversity of voting influence and provides flexibility in the project funding level.



Image source: — Photo by Hope Ann Flores |
The State News

Team



Dr. Kenric Nelson, President & Founder of Photrek, USA

- Inventor of Information Fusion Algorithms
- Creator of *Nonlinear Statistical Coupling* model of Complex Systems
- Role: Team Lead and Complex Systems Modeling



Dr. André Vilela, Física de Materiais, Universidade de Pernambuco, Brazil

- Voting Dynamics, Economic Models, Complex Networks
- Center and Laboratory for Simulation on Complex Systems
- Role: Simulation and Mathematical Design



Megan Hess, Wada, Cameroon

- Sub-Regional coordination lead for Central Africa
- Francophone liaison and Cameroon Team Lead
- Role: Communication and Community Engagement

Project Objectives & ROIs

Fund 4: Determine Approach to Diversified Voting Influence

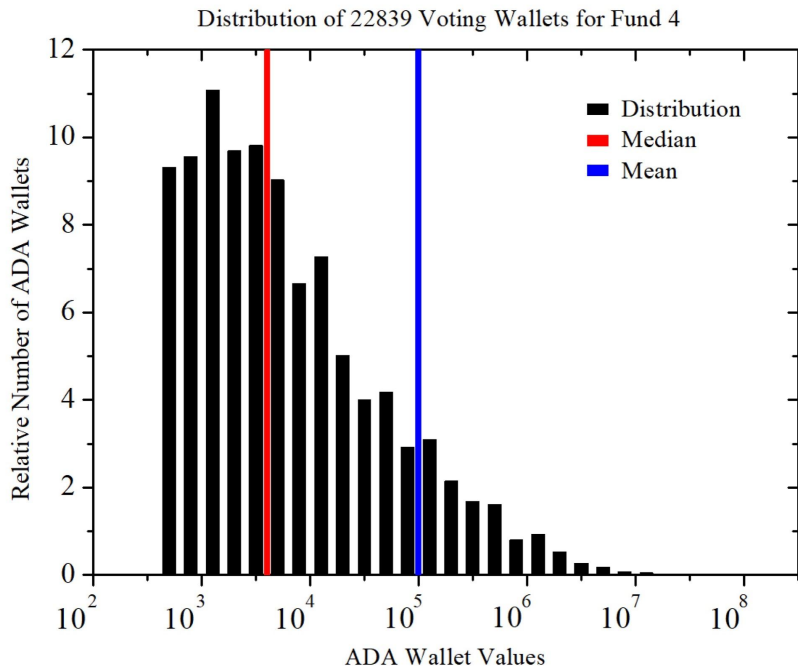
- What method diversifies voting influence? Quadratic, Square-root, or a Generalization?

Fund 6: Design and Simulation

- What are the dynamics of the proposed voting method?
- How can funding be more lenient in its allocation?

Fund 7 Challenge: *Prototype Voting Influence Method*

ADA distribution across wallets: Fund 4

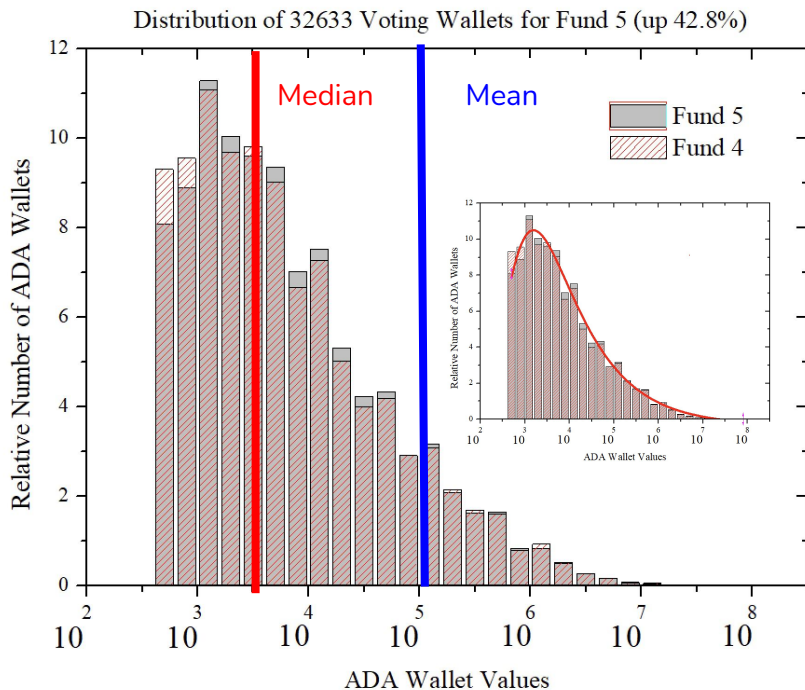


1. The red line represents the median of the distribution (~4,000 ADA), which is to say half of the wallets are below or above this point.

2. The mean is much larger (~10,000 ADA) due to the heavy-tail characteristic of the distribution.

3. Our goal is to determine a voting strategy that will be more influenced by the median of the wallet sizes.

ADA distribution across wallets: F4 & F5



Total Wallets	32633	↑ 42.8%
Maximum	7.44535×10^7	↑ 39.5%
Minimum	450	0%
Median	4361	↑ 8.3%
Mean	97496	↓ 3.1%
Standard Deviation	822226	↑ 6.8%
Sum	3.18158×10^9	↑ 34.5%



Wallet size and decision power

	Strong Opinion Votes needed to achieve a decision with a specified probability	
Random Choice votes	84.1%	99.9%
25	5	15
10 000	100	300
2.3 Billion Fund 4	~ 48 000 ADA	~ 144 000 ADA
3.2 Billion Fund 5	~ 57 000 ADA	~ 170 000 ADA



Example of more diversified influence

1 coin 1 vote →

1 coin 1 decision power index

Decision Power Index: probability that a particular coin is the deciding voting

- Square root model

voting power (vp) = $\sqrt{\text{wallet}}$

100 ADA → **10 vp**

Self-selecting areas of expertise
& Expressing preferences via
budget-like decision making

- Quadratic voting method

Cost of voting $\sim v^2$

1 vote → **1 vp**

3 votes → **9 vp**

10 votes → **100 vp**

Square-root and Quadratic Voting Example

$10^4 \longrightarrow 100$
 $10^6 \longrightarrow 1000$

QUADRATIC VOTING!

P_1 P_2 P_3 P_4 P_5

votes	1	2	3	4	5	6	7	8	9	10
1	1	4	9	16	25	36	49	64	81	100

cost

1	1	3	5	10	12	16	20	25	30	31
1	1	1	1	25	100	144	256	400	625	900
										961

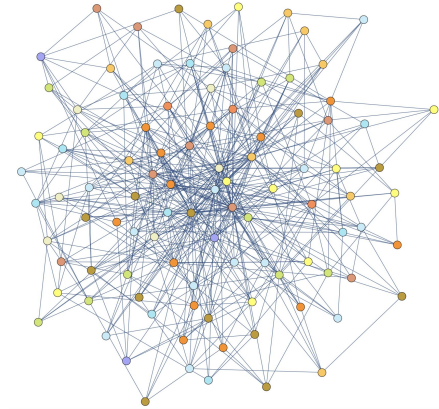
$\frac{10000}{1000000} \rightarrow 100x$
 $\frac{10}{30}$

$100 \longrightarrow 3$

Fund 6: Design & Simulation

Objectives and Potential Impact:

- (1) Model agent-based opinion, voting, and funding dynamics
 - Ability to evaluate different voting methods
- (2) Monte Carlo Simulation of methods
 - Deliver rich datasets of voting method outcomes
- (3) Power-law analysis of voting power influence
 - Knowledge regarding voting distributions, methods, & decision power influence
- (4) Design and analyze methods for providing flexible funding levels
 - Ability to modulate exact funding level of projects
- (5) Design an equitable voting and funding protocol
 - Ready to develop prototype



Key Staff:

- Vilela - Complex Systems Scientist
- Nelson - Project Lead & Analysis
- Hess - Communication
- TBD - Design Specification

Budget Request: \$50,000

Schedule: Nov 2021 the Jan 2022



Fund 7 Challenge: Prototype Diversified Voting Method

Proposed Objectives

- Execute a demonstration vote using square-root, quadratic, or related generalizations of these weighted voting methods.
- Allow for a flexible funding award so that high-quality projects are not eliminated by small differences in the proposed and available budget.
- Provide evidence for evaluation of the effectiveness of the weighted voting to:
 - a) Provide a balanced influence across cohorts of wealth
 - b) Increase the participation in the Cardano Catalyst voting process
 - c) Provide flexibility in deciding on the funding level for projects

Budget Request: \$150,000

Join us in empowering the communities voice
Thank you for listening



Community Photo
IOHK Summit 2019