# Diversify Voting Influence

Cardano Catalyst Fund 4 Close-Out Report, October 2021

https://cardano.ideascale.com/a/dtd/Diversify-Voting-Influence/340657-48088

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## Challenge and Project KPIs Addressed

The Decentralized Decision-Making Challenge for Fund 4 was focused on "High-quality and decentralized decision-making, will increase treasury ROI and legitimize decentralized governance." The key metrics such as "Community Confidence" and "Community Participation" are challenging for one project to measure directly. Nevertheless, our *Diversify Voting Influence* (DVI) project directly addresses the guiding questions, which will be used to summarize our KPIs.

1. How do we encourage people to participate in decision-making?

   *Project KPI: Identify 3-5 voting methods that improve the diversity of influence*

   *DVI provided quantitative information to the Cardano Catalyst regarding the distribution of voting influence across wealth cohorts. Based on an extensive scientific literature review, we showed that a square-root allocation of votes per ADA would provide a more balanced decision-making process. Rather than a one-coin <> one-vote policy we recommend a principle of one-coin <> one voting power index. Ensuring this type of balance in voting power will encourage a broader spectrum of people to participate in the decision-making.*

2. How do we ensure the group of decision-makers is diverse and accessible to newcomers?

   *Project KPI: Develop analytical tools that quantify the influence of voters*

   *DVI quantified the current disparity in voting influence between low-ADA wallets and high-ADA wallets. This is shown in the red bar chart on slide 8 of the DVI Final Presentation. The combined votes of the wallets with ~500 ADA is not visible on the log-scale necessary to show the influence of other cohorts. Thus newcomers and diverse communities are not currently able to express a meaningful opinion about the Catalyst proposals. In contrast, the square-root allocation of votes (shown in gray in this same plot) can be represented using a linear scale and shows that the voting influence of the 2637 wallets in the ~500-ADA cohort is similar to the 16 wallets in the ~10 M-ADA cohort.*

3. How can we ensure that the Catalyst process keeps iterating to improve?

   *Project KPI: Develop a plan to simulate the dynamics of diversified voting methods*

*DVI analysis provided an insightful overview regarding wealth distribution, and the feedback we've had from the community was consistent with the concerns that our team addressed. We believe that further investigation of voting power scaling laws, combined with numerical simulations and community feedback, may shed light on a voting scheme that promotes the diversity of voting influence across the Cardano ecosystem.*

How will we include the community in decision-making?

*Project KPI: How will we engage and communicate with the Catalyst community to ensure that our tools and methods are understood?*

*DVI encourages informed participation by the Catalyst community in meetings, town halls, podcasts, and presentations. We support that influential public associations can provide nuanced and collective views about the unbalanced voting power investigation. The DVI establishes a trusted dialogue with the community by providing reliable and relevant information broadcasted through different channels and events, thus empowering the public to engage and get involved.*

## Key Achievements

During Cardano Catalyst Fund 4 and 5 votings, the size of ADA wallets spanned from 450 Ada to 74 M Ada (Slide 6). The disparity in the median (~4 K Ada) and the mean (~10 K Ada) is indicative of the power-law decay of the distribution's tail. A stretched exponential function provides a close fit to the distributions. One way to encapsulate how this impacts influence is to examine the effect of strong opinions, where holding one wallet fixed in its opinion while allowing all the other wallets to fluctuate randomly. For the 5 B Ada cast in Fund 5, a strong-opinion wallet of 170 K Ada would win 99.9% of the time. This fundamental statistic of the majority voting illustrates the impact of such discrepancy of polling with wallet size.

The scientific literature (Slide 13) emphasizes the importance of square-root allocation of representative votes as an approach to ensuring that each individual continues to have equal voting power despite the unequal distribution of voters per representative. Given the centrality of this well-known result, we focused our initial investigation on the effect of applying a square-root allocation of votes. Our results on Fund 5 allocation (Slide 7), show that the peak of influence shifts from ~1 M to ~500 M Ada, and the lowest cohorts have noticeable influence that grows gradually, thus providing significantly more balance of influence across the wealth cohorts.

Despite the promising result of using square-root allocation of votes, there is a legitimate concern that such an allocation would motivate splitting of wallets or a so-called "Sybil Attack". Counteracting such an attack can be addressed in three ways, a) considering a more gradual power-law allocation such as $2/3^{rds}$, $3/4^{ths}$, or $4/5^{ths}$; b) measuring correlations in voting across wallets and allocating weights accordingly, or c) utilizing a digital identity as part of the voting registration.

While not part of our original research objectives, the newly proposed *Quadratic Voting* (QC) method is based on the *Vickery-Clarke-Groves mechanism*. QC treats votes as a budget that must be allocated across the collection of proposals under consideration. Extreme opinions are discouraged

by incrementing the cost of allocating more than one vote to a proposal according to a quadratic cost. The system has been shown to provide Gaussian-shaped distributions of opinions, in contrast to opinion polls which tend to encourage highly asymmetric distributions of opinion. A related mechanism *Quadratic Funding* has been already successfully implemented by Gitcoin for the Ethereum community.

## Key Learnings

## Next Steps

1) The DVI team has proposed "Design & Sim of Voting Influence" for Fund 6 and a Fund 7 Challenge "Prototype Diversified Voting Method", with a focus on performing Monte Carlo simulations to support the design of a DVI system and on to prototype the method for the Fund 8 challenges. While these proposals were not awarded, the DVI team plans to improve these proposals.

2) An implementation for the Cardano Catalyst system should start with a modest power-law allocation, such as a $4/5^{ths}$ rule.

3) Complete analysis of correlation weighted allocations to determine whether: a) correlations between voting wallets can be accurately measured; b) an appropriate weighting across correlated cohorts can be applied; and c) whether a correlated weighting is simple, understandable, and equitable.

4) Incorporate Quadratic Voting into the process so that: a) each voter can focus their influence on the proposals of interest rather than being responsible for voting across all of the projects, and b) each voter is incentivized to be modest rather than extreme in their opinions.

5) Investigate the integration of digital identity into the voting process to determine how and when such an identity can be incorporated into the Cardano Catalyst voting process.

## Final Comments

A solid understanding of the public's values and ideas should center every scientific and mathematical investigation on the Catalyst community voting dynamics. We identify the current unbalanced voting influence as a critical hazard for the equitable development of the Catalyst environment. We believe that well-known mathematical methods, such as square-rooting voting power scaling and quadratic voting costs, make fair voting mechanics achievable, driving the influence to broader participation. This knowledge helps ensure that community decisions are optimal for its participants and best fit current conditions and needs.

## Resource Links

- DVI Video Final Report - 5 minutes
- DVI Video Final Report - 50 minutes
- DVI Github Repository
- DVI Bibliography