SNAPSHOT VOTING POWER ANALYSIS

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Summary :

This report aims to explore the voting patterns across various proposals and voters within the Arbitrum DAO blockchain ecosystem. The analysis delves into understanding trends and patterns within the off-chain voting system, including the distribution of voting power among voters, outlier detection, voter engagement, and proposal-specific insights.

Introduction :

Snapshot serves as a platform for conducting off-chain voting on proposals posted by various DAOs. The analysis presented here seeks to provide insights into the voting behaviors of both voters and proposals within the Arbitrum DAO ecosystem.

Methodology :

1. **Data Collection:**
   - Gathered votes data from closed proposals within the Arbitrum DAO Ecosystem using the Snapshot GraphQL API Endpoint.
   - Utilized GraphQL queries to retrieve relevant data from the API.

2. **Data Preprocessing:**
   - Conducted preprocessing tasks to prepare the data for analysis.
   - Formatted the data in a suitable structure conducive to analysis.
   - Converted data types as necessary for consistency and accuracy.
   - Checked for missing values and handled them appropriately.
   - Created new columns derived from existing ones to enhance analysis capabilities.

3. **Analysis Approach:**
   - Employed a multifaceted analysis approach to uncover insights into voting patterns, voter behavior, and proposal outcomes within the Arbitrum DAO ecosystem.
   - Utilized descriptive statistics to understand the distribution of voting power and conduct outlier analysis.
   - Employed visualization techniques such as bar charts, pie charts, and histograms to visualize the distribution of voting power among voters and across different proposals.
   - Conducted exploratory data analysis to identify clusters of voters with high voting power and assess their influence on proposal outcomes.
   - Investigated temporal patterns in voting behavior to uncover seasonal or cyclical trends.

- Explored the relationship between voting power and voter engagement metrics to understand the level of voter participation and its impact on proposal outcomes.

Insights into Voting Patterns and Proposal Outcomes in Arbitrum DAO ;

Distribution of Voting Power of all Voters

1. **Distribution of Voters Based on their Total Voting Power Across Proposals**

Box Plot of Voters based on their Total Voting Power across All Proposals
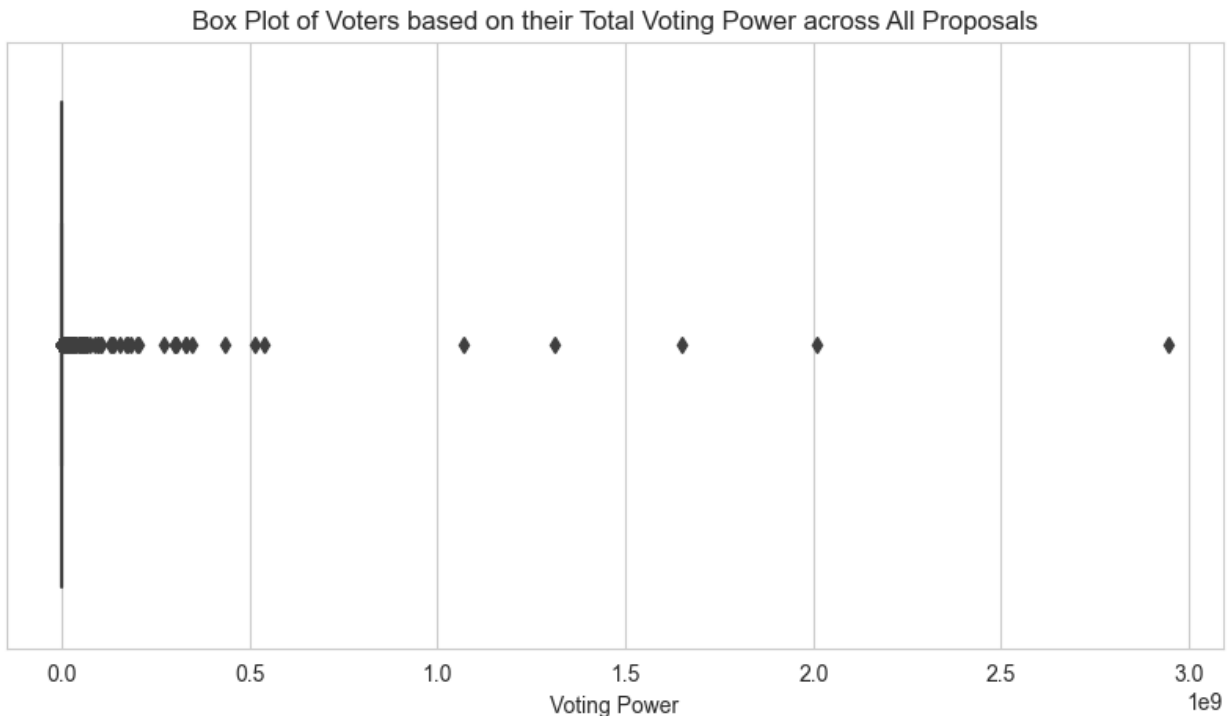
Insights: The box plot above illustrates the distribution of voters based on their total voting power across all proposals within the Arbitrum DAO ecosystem. The statistics reveal that the total voting power of voters ranges from 1 to 2944.637 million(2.945 billion), with a mean of approximately 115.10 thousand and a standard deviation of approximately 11.79 million. Notably, certain voters possess higher voting power compared to others, suggesting potential disparities in influence among participants.

2. Distribution of Voters Based on their Average Voting Power across all Proposals

Interactive KDE Plot of Voting Power with Mean
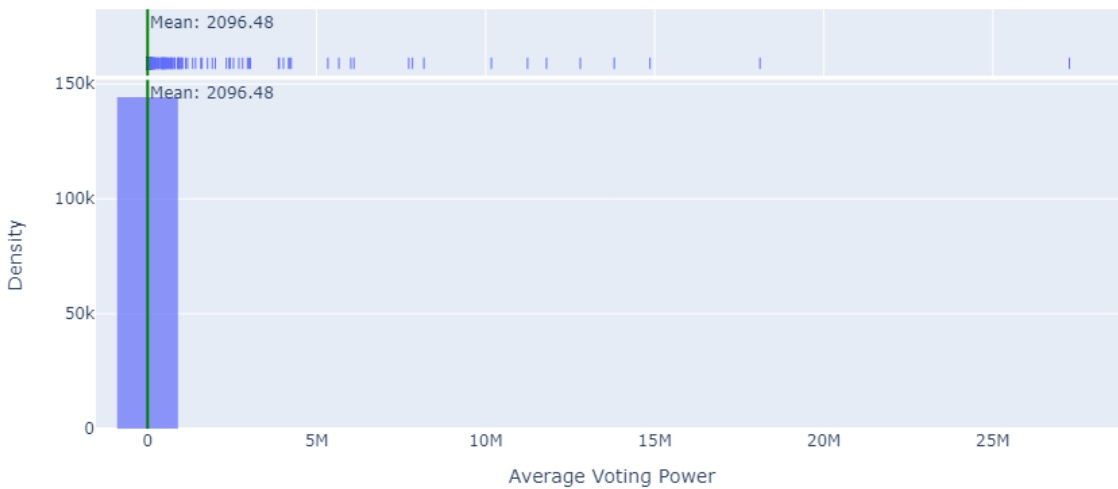
Source: [Graph Link](#)

Insights: The graph above displays both a histogram and a box plot of the average voting power of voters across all proposals within the Arbitrum DAO ecosystem. The vertical line indicates the mean of the distribution. The summary statistics indicate that the average voting power ranges from 1 to approximately 27.27 million, with a mean of approximately 2,096.48 and a standard deviation of approximately 132,866.00.

Overall, the analysis provides insights into the distribution and variability of average voting power among participants/voters, highlighting the diversity of influence within the Arbitrum DAO ecosystem.

Distribution of Voters based on different ranges of voting power

Distribution of Voters Based on Voting Power
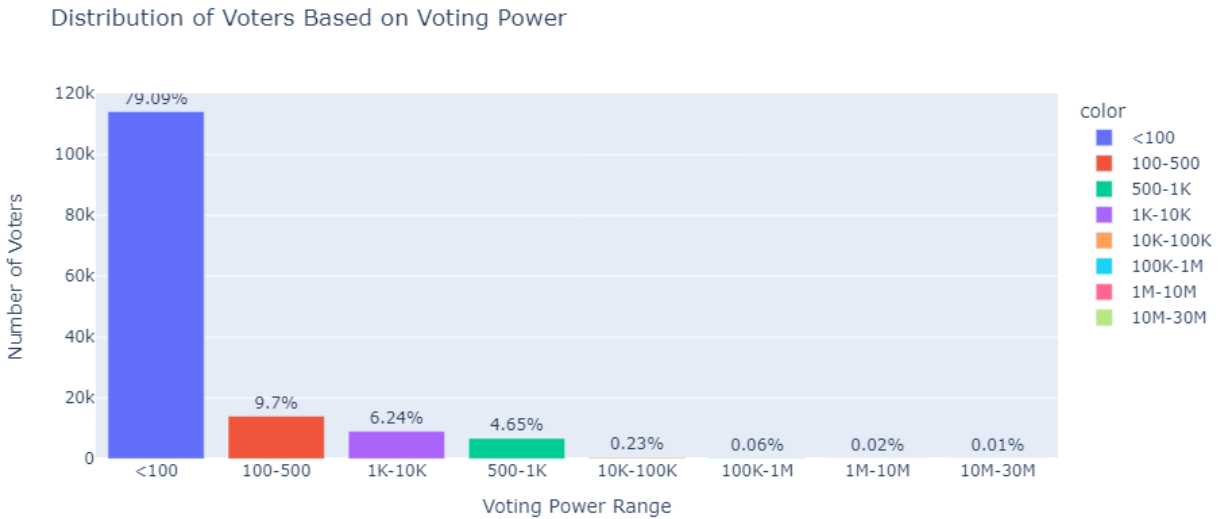
Source: Graph Link

Insights: The histogram illustrates the distribution of voters based on different ranges of voting power. The analysis reveals that the majority of voters, constituting 79%, possess an average voting power less than 100. As the range of voting power increases, there is a noticeable decline in the number of voters. For instance, only 0.01% of voters fall within the range of 10 million to 30 million, comprising just 8 voters. Similarly, the range of 1 million to 10 million encompasses 34 voters, accounting for 0.02% of the total.

This distribution underscores the disparity in voting power among participants, with a vast majority holding relatively low levels of influence. Additionally, it highlights the presence of a small but influential minority with significantly higher voting power, potentially exerting disproportionate influence on proposal outcomes.

Voter Influence Analysis

1. **Identification of High-Influence Voters:**
    *   Identified a cluster of 53 voters possessing at least 1 million voting power in one or more proposals they have voted for.
2. **Calculation of Total Voting Power:**
    *   Calculated the combined voting power of these high-influence voters for each proposal.
3. **Assessment of Voter Influence:**
    *   Determine the percentage of total voting power contributed by the high-influence voters for each proposal.
4. **Filtering Proposals by Influence Threshold:**
    *   Filtered proposals where the voting power of the identified high-influence voters constituted 90% or more of the total voting power.
5. **Analysis Results:**
    *   Out of 114 basic voting type proposals, 96 were found to have 90% or more of their voting power contributed by the identified high-influence voters.

This analysis underscores the significant influence wielded by a small group of voters with substantial voting power, highlighting potential disparities in decision-making outcomes within the Arbitrum DAO ecosystem.

Analysis of Voter Influence on Proposal Outcomes:

Insights:

The analysis delved into the influence of specific voters on proposal outcomes within the Arbitrum DAO ecosystem. By examining the voting behavior of 53 high-influence voters, it was observed that their collective voting power often led to discrepancies between the proposed choice with the highest votes and the choice favored by these influential voters. In 15 instances, the preferred choice of the 53 voters contradicted the choice with the highest overall votes for a given proposal. For instance, in the proposal 'AIP 1.05: Return 700M $ARB to the DAO Treasury [REAL],' although the majority of voters (30,832) favored the 'For' choice, the substantial voting power wielded by the 53 influential voters led to the 'Against' choice prevailing, resulting in the proposal's failure to pass. This underscores the significant impact of high-influence voters on proposal outcomes, often overriding the preferences of the broader voter base.

The below given table shows the results of all 15 proposals:

proposal_title	choice_of_voters_high_voting_power	vote_count	choice_of_majority	majority_vote_count
AIP 1.05: Return 700M $ARB to the DAO Treasury [REAL]	Against	31	For	30832
AIP-1: Arbitrum Improvement Proposal Framework	Against	25	For	20404
Accelerating Arbitrum - leveraging Camelot as an ecosystem hub to support native builders	Against	13	For	28662
Archi Finance STIP Proposal - Round 1	Abstain	8	Against	7916
Equilibria STIP Proposal - Round 1	Against	8	For	10651
Florence Finance STIP Proposal - Round 1	For	6	Against	8303
Lido STIP Proposal - Round 1	For	14	Against	8295
Prime Protocol STIP Proposal - Round 1	Against	8	For	8092
Range Protocol STIP Proposal - Round 1	Abstain	8	For	11418
StakeDAO STIP Proposal - Round 1	For	9	Against	8976
Webacy STIP Proposal - Round 1	Against	11	For	8188
Wombat Exchange STIP Proposal - Round 1	Abstain	8	Against	11181
Wormhole STIP Proposal - Round 1	Against	13	For	9124
XY STIP Proposal - Round 1	Against	12	For	8065
[Non-Constitutional] Fund the Arbitrum Grants Framework Proposal Milestone 1	Against	9	For	24452

Conclusion:

The analysis highlights the considerable influence wielded by a select group of voters within the Arbitrum DAO ecosystem. When these influential voters align their votes with a specific choice in a proposal, the likelihood of that proposal passing significantly increases. This underscores the pivotal role played by high-influence voters in shaping the outcomes of proposals, potentially overriding the preferences of the broader voter base. As such, understanding and accounting for the voting behavior of these influential stakeholders is crucial in gauging the success or failure of proposals within the DAO ecosystem. The DAO can also experiment with few non-high value proposals which can have one voting power for one vote; these can act as an "and" condition.

Proposal Specific Analysis

Analysis of Voting Power Disparity Among Proposals:

index

Total Voting Power for Each Proposal

Source: [Graph Link](#)

The scatter plot above visualizes the total voting power across all 114 basic-type proposals within the Arbitrum DAO ecosystem. Each point on the graph represents a proposal, with the x-axis indicating the proposal titles and the y-axis representing the total voting power of each proposal.

Key Observations:
- **Voting Power Distribution:** The data points are color-coded to denote varying levels of total voting power. Proposals with a total voting power of less than 100M are depicted in red, indicating relatively lower voting power compared to others.
- **High-Voting Power Proposals:** Conversely, proposals with voting power exceeding 200M are represented in blue, highlighting their substantial influence within the ecosystem.
- **Moderate-Voting Power Proposals:** Proposals with voting power falling between these thresholds are depicted in green, signifying a moderate level of influence.

Insights:
- **Disparity in Voting Power:** The visualization underscores the considerable variation in voting power among proposals, with some wielding significantly higher or lower influence compared to others.
- **Implications:** This disparity may impact the decision-making process within the DAO, potentially skewing outcomes in favor of proposals with higher voting power.

- **Considerations:** Further investigation into the factors driving voting power disparities could provide valuable insights into the dynamics of proposal evaluation and decision-making within the Arbitrum DAO ecosystem.

Comparative Analysis of Voting Power Distribution Across Proposal Types:
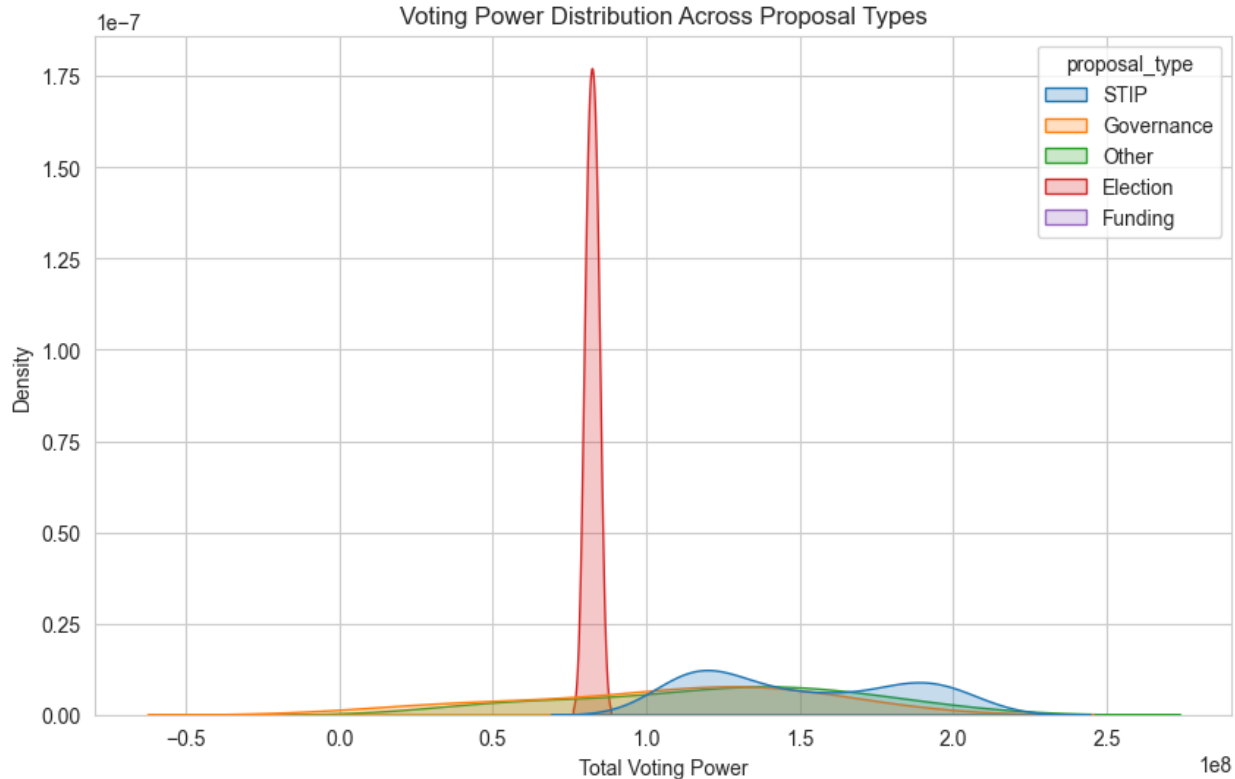
The graph above illustrates the distribution of voting power among proposals categorized into different types, including Election, Funding, STIP, Governance, etc.

Methodology:

1. **Proposal Classification:** Proposals were classified based on keywords extracted from their titles, enabling the identification of various proposal types.
2. **Visualization:** A Kernel Density Estimation (KDE) plot was employed to visualize the distribution of voting power across different proposal types.

Key Observations:

- **Distinct Distributions:** The KDE plot showcases distinct distributions of voting power among different proposal types.
- **Election Proposals:** Notably, election-type proposals exhibit the highest voting power distribution compared to other proposal types.

- **Variability:** The plot highlights significant variability in voting power distribution across different types of proposals, indicating varying levels of influence and significance within the Arbitrum DAO ecosystem.

Insights:

- **Proposal Type Influence:** The observed disparities in voting power distribution underscore the differing levels of importance and impact associated with various proposal types.
- **Strategic Considerations:** Understanding the distribution patterns of voting power across proposal types can inform strategic decision-making and resource allocation within the DAO.
- **Potential Implications:** Proposals of certain types may inherently attract more attention and support from voters, potentially influencing decision outcomes and governance processes.

Temporal Analysis of Voting Power Dynamics

Hourly Voting Power Trends Across Proposals:
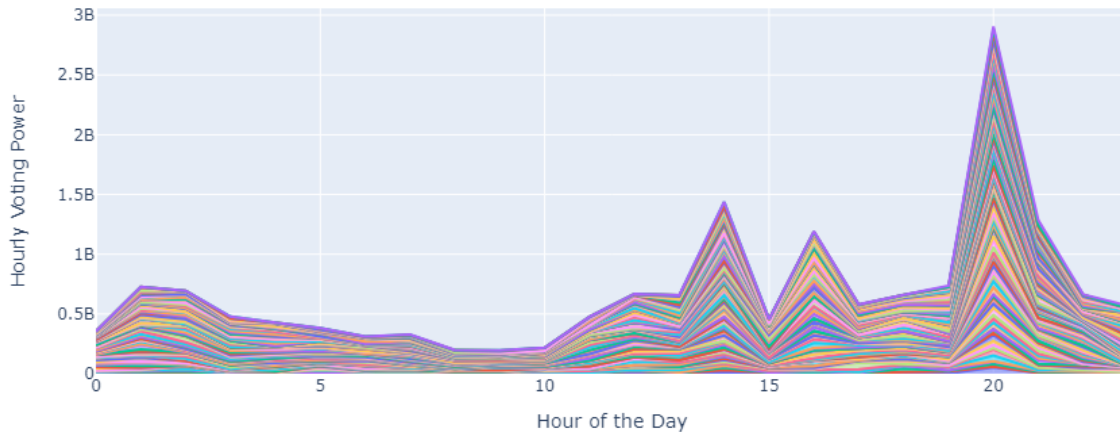
Source: Graph Link

The presented stream graph illustrates the hourly voting power distribution for each proposal within the Arbitrum DAO ecosystem. Along the x-axis, the hours of the day are displayed, while the y-axis represents the voting power.

1. **Observation:**
   - The peak of voting power occurs during the 20th hour, with hourly variations ranging from 0 to 23.
   - The graph reveals that the lowest voting power is observed during the hours between 8 to 10. This period exhibits a dip in voting activity compared to other hours throughout the day.
2. **Conclusion:**
   - It can be inferred that during the hour with the highest voting power, which is at hour 20, there is a notable presence and activity from voters with high voting power. Their engagement during this hour contributes significantly to the overall voting power observed at that time.

Voter Engagement Analysis

This analysis focuses on voters with substantial voting power, specifically those who possess more than one million voting power in at least one proposal they have voted in. There are a total of 53 such high-powered voters identified. The graph below illustrates the engagement level of these 53 voters by displaying the count of proposals they have participated in.

Voter
Number of Proposals Participated by Each Voter with High Voting Power
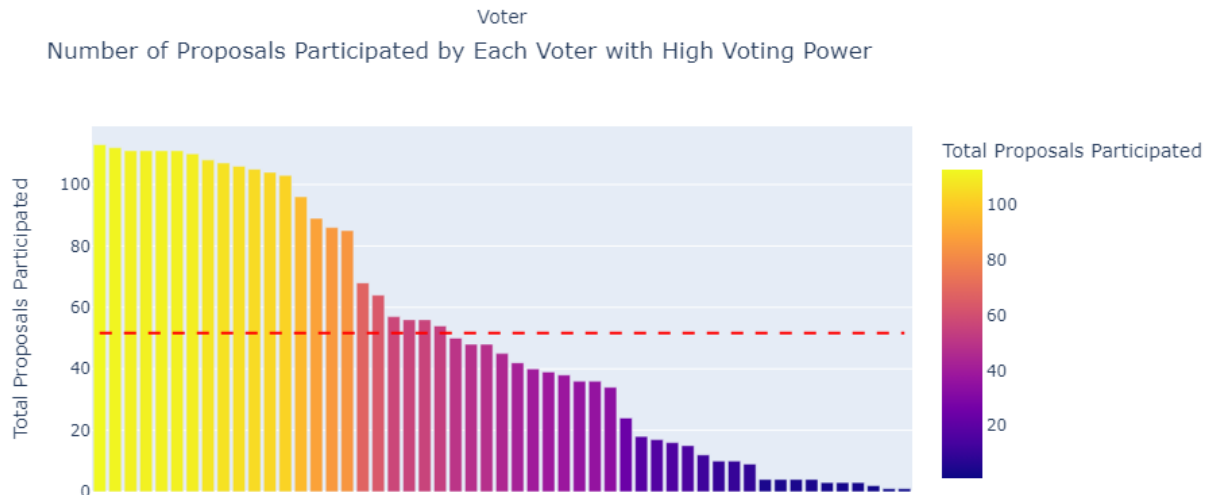
Source: Graph Link

Insights from Voter Engagement Analysis:

1. **High Engagement Among Voters:** The analysis reveals that voters with high voting power, defined as those possessing more than one million voting power in at least one proposal they have voted in, demonstrate significant engagement in the voting process. Among the 53 identified voters with high voting power, the average number of proposals they have participated in is 51.

2. **Varied Participation Levels:** The graph illustrates a range of engagement levels among the identified group of voters. While some individuals have participated in a relatively lower number of proposals, others have demonstrated extensive engagement by actively participating in a larger number of proposals.

3. **Mean Engagement Level:** The mean engagement level, represented by the horizontal line at 51 on the graph, serves as a reference point for assessing the overall participation rate among voters with high voting power. This value indicates the average number of proposals each voter in the identified group has participated in.

4. **Implications of High Engagement:** The high level of engagement observed among voters with significant voting power suggests their active involvement in decision-making processes within the DAO ecosystem. Their participation in a diverse range of proposals indicates their influence and stake in governance activities, potentially shaping the outcomes of proposals and governance decisions.

5. **Potential Areas for Further Investigation:** While the average engagement level provides valuable insights into overall participation trends, further analysis may be warranted to explore variations in engagement patterns among individual voters. Understanding the factors driving differences in participation rates could offer deeper insights into the dynamics of voter engagement and its impact on proposal outcomes.

Overall Conclusion:

The analysis conducted on the voting patterns of voters and proposals based on voting power within the Arbitrum DAO blockchain ecosystem provides valuable insights into the dynamics of governance and decision-making processes. Here are the key findings and conclusions drawn from the analysis:

1. **Distribution of Voting Power:**
- The distribution of voting power among voters exhibits significant variation, with certain participants possessing substantially higher influence compared to others.
- A majority of voters have relatively low levels of voting power, while a small minority wields considerable influence, potentially impacting proposal outcomes.

2. **Voter Influence Analysis:**
- A cluster of high-influence voters, with voting power exceeding 1 million, significantly influences proposal outcomes, often overriding the preferences of the broader voter base.
- These high-influence voters contribute a significant portion of the total voting power for many proposals, highlighting potential disparities in decision-making outcomes.

3. **Proposal-Specific Analysis:**
- There is a notable disparity in voting power among proposals, with some wielding significantly higher influence compared to others.
- Certain proposal types, such as election-type proposals, exhibit higher voting power distributions, indicating their greater significance within the ecosystem.

4. **Temporal Analysis of Voting Power Dynamics:**
- Hourly voting power trends reveal peak activity during specific hours, with fluctuations observed throughout the day.

- Understanding temporal voting patterns can provide insights into voter engagement and strategic decision-making.

Resources:-

- Snapshot API Docs (For getting snapshot votes data):- https://docs.snapshot.org/tools/api
- Lighthouse (for hosting visualization file):- https://docs.lighthouse.storage/lighthouse-1
- Python Plotly Docs for Visualization:- https://plotly.com/python/
- Python Pandas Docs for Data Manipulation:- https://pandas.pydata.org/docs/
- Pinata IPFS (for hosting dataset):- https://black-decisive-cobra-689.mypinata.cloud/ipfs/

Dataset used:-

Dataset Link