Aliquo: The Decentralized Reserve Asset Protocol

Abstract. We present a community-governed protocol dedicated to creating, issuing, and maintaining a decentralized reserve asset built on top of ERC-721. Our approach proposes a flywheel mechanism that makes the protocol collect the earnings from royalties over secondary sales of the NFTs and reinvest in ether, bitcoin, and USD-pegged stablecoins to become accrued as backed value for the non-fungible tokens themselves. Those reinvested earnings are allocated to a multi-signature protocol reserve, which is safeguarded and managed by a decentralized organization of token holders. In its turn, the protocol reserve is fractionalized in a fixed number of stakes with a theoretical ratio of 1:1 between the stakes and the token supply, on which the token supply cap is the coefficient of the number of stakes, and each stake collateralizes 1:1 the floor price of each NFT.

1 Introduction

From PFPs to Generative Art, NFTs adoption has seen exponential growth during the rampant frenzy generated in 2021, bringing a massive influx of new retail interest. However, it still represents a thin layer of how deeply the fundamentals of NFTs technology can be explored and leveraged.

In its turn, rather than being designed as a blockchain-based digital collectible, artifact, or artwork, Financial NFTs are designed to carry some underlying financial utility or application, instead of having the visual output and traits rarity as their main product. The Financial NFTs can include everything: from bonds and security-based swaps to baskets of tokens.

Addressing the potential of leveraging the fundamentals of NFTs technology as a key pillar, we're introducing Aliquo, a decentralized reserve asset protocol on the Ethereum blockchain. Community-governed, the mission of Aliquo is to create, issue, and maintain the consistency of AQ1.

Built upon ERC-721, AQ1 is a native reserve asset on Aliquo that is collateralized and backed 1:1 by a 0,1% stake in a protocol reserve that captures earnings from royalties over secondary sales; with a supply cap of 1,000 NFTs. Through AQ1, Aliquo comprises existing mechanisms widely adopted by the crypto market (e.g., royalties over secondary sales, token-gated community, decentralized organization, multi-signature wallet) to present an ERC-721 token structured on underlying financial features: *Royalties as Liquidity (RaL)*, *Reserve-Backed*, *Proof of Value (PoV)*, *Protocol Ensured Value (PEV)*, *Non-Inflationary*, and *Free-Floating*.

2   Aliquo Protocol

Aliquo is a decentralized reserve asset protocol on the Ethereum blockchain dedicated to creating, issuing, and maintaining AQ1: an ERC-721 token designed to function as a hedge against inflation and store of value, providing a decentralized, permissionless option to mitigate financial risk, with equal access to everyone.

Aliquo has a framework made of three pillars:

- **AQ1** are 1,000 NFTs backed 1:1 by a 0,1% stake in the Aliquo Treasury. Fueled by a flywheel mechanism, AQ1 collects the earnings from royalties over secondary sales to accrue as backed value for the token itself.
- **Aliquo DAO** is the decentralized organization of AQ1 token-holders responsible for the governance of Aliquo.
- **Aliquo Treasury** is the protocol reserve backing the value of AQ1, controlled by Aliquo DAO. The earnings from royalties over secondary sales of AQ1 are reinvested in underlying assets and allocated to the Treasury.

3   AQ1

AQ1 is an ERC-721 token collateralized 1:1 with a 0,1% stake in the Aliquo Treasury, backed by a basket of underlying assets (ETH, WBTC, LUSD, and DAI), with a hard-capped supply of 1,000 NFTs.

The Aliquo approach introduces a flywheel mechanism that makes the protocol collect the earnings from royalties over secondary sales of AQ1 to reinvest in underlying assets, which are allocated to the Aliquo Treasury to collateralize and back the floor price of AQ1 itself. In its turn, Aliquo Treasury collateralizes the backed floor price of AQ1 with a theoretical ratio of 1:1 between the Treasury's assets value (100%) and AQ1 supply cap (1,000).

AQ1 serves as the Aliquo's governance token via Aliquo DAO. This means AQ1 token-holders exercise full control over the consistency of AQ1 by dictating Aliquo through a decentralized organization of AQ1 token-holders.
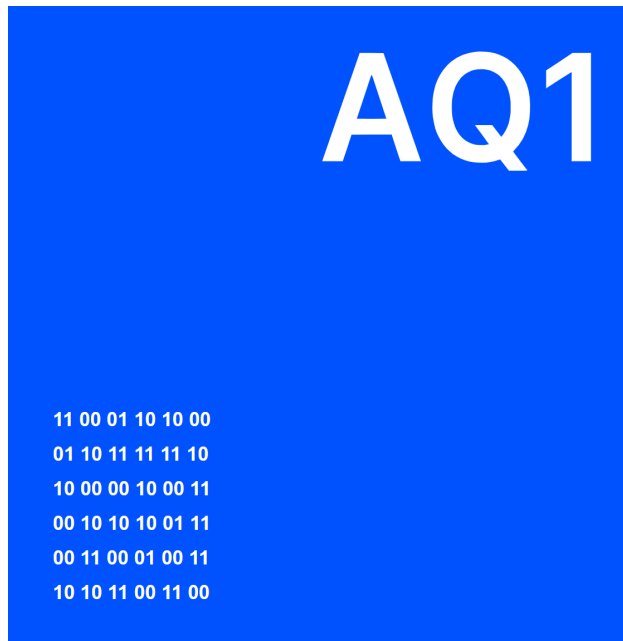
Example of AQ1

3.1 Royalties as Liquidity (RaL)

By default, AQ1 has 10% of royalties over secondary sales, of which 9%[1] is reinvested in underlying assets and allocated to the Aliquo Treasury to back the value of AQ1 itself. Through a flywheel mechanism, Aliquo adds biweekly the profit earned from royalties over secondary sales of the entire token supply back to the principal amount of the 1,000 NFTs, providing a long-term, virtuous cycle of compounding the backed floor price of AQ1.

With royalties over secondary sales serving as Aliquo's stream to provide protocol-owned liquidity, *Royalties as Liquidity (RaL)* is the token feature that makes the entire token model design of AQ1 structurally viable, economically sustainable, and conceptually plausible.

3.2 Reserve-Backed

Each AQ1 is collateralized 1:1 by a stake of 0,1% in the Aliquo Treasury, being backed and tied to a reserve of underlying assets that includes Ether, Wrapped Bitcoin, Dai, and Liquity USD.

Aliquo Treasury, the protocol reserve to which the earnings from royalties over secondary sales of AQ1 are allocated after being reinvested in ETH, WBTC, LUSD, and DAI, is

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[1] The remaining 1% from 9 of 10% of the revenue generated by royalties fees is dedicated to protocol operation costs.

fractionalized in 1,000 stakes with a theoretical ratio of 1:1 between the Treasury's assets value (100%) and the AQ1 Supply Cap (1,000). Each stake, which equals a 0,1% stake in the Aliquo Treasury, collateralizes 1:1 the backed value of each AQ1. This means the backed floor price of each AQ1 is pegged 1:1 with a 0,1% stake in the Treasury, tied to the underlying assets the protocol reserve represents.

In the end, in addition to providing on-chain proven value for NFTs, *Reserve-Backed* provides, as a token feature, a predictable unit of value for AQ1: "*collateralized 1:1 with a 0,1% stake*".

3.3   Proof of Value (PoV)

Proof of Value (PoV) is the method to audit the backed floor price of AQ1. It works as a due diligence process where anyone can verify the Aliquo Treasury's assets value in the root, tracking it on block explorers. Through an on-chain verification of the total assets that Aliquo Treasury holds, anyone can calculate and attest the 0,1% stake collateralizing 1:1 the backed floor price of each AQ1.

$$PoV = \frac{TAV}{AQ1_{SC}}$$

- PoV denotes *Proof of Value*, TAV denotes *Treasury Assets Value* (100%) and $AQ1_{SC}$ denotes *AQ1 Supply Cap*, which is 1,000.

3.3.1   Treasury Assets Value

$$TAV = a_1 + a_2 + a_3 + a_4$$

- TAV denotes *Treasury Assets Value*, and a_1, a_2, a_3, and a_4 denote individually the value (measured in USD) of the allocation of each of the four underlying assets held in the Treasury ($a_1 = ETH$, $a_2 = WBTC$, $a_3 = LUSD$, and $a_4 = DAI$). This means *Treasury Assets Value* is calculated by summing the value, measured in USD, of the allocation of each underlying asset held at the Treasury.

3.4   Non-Inflationary

AQ1 is non-inflationary, having a hard-capped supply of 1,000 NFTs. This means after the entire token supply of AQ1 is minted, the smart contract perpetually shutdowns the token emission. Immutable, the supply cap is embedded in the smart contract code and anyone can verify it.

It's correct to assume that the token model design of AQ1 sacrificed scalability to preserve and protect the monetary policy, having supply-induced scarcity as a pivotal feature to structure the token economics of AQ1.

3.5   Protocol Ensured Value (PEV)

100% of the Aliquo Treasury's assets value is employed to collateralize the backed value of AQ1. Assuming that Aliquo does not sell funds from the Treasury's balance sheet and there's no new token issuance after the 1,000 NFTs become minted, the protocol ensures that the backed floor price of AQ1 is always collateralized 1:1 by a 0,1% stake in the Treasury (1,000/100%), not falling below.

If Treasury's assets value is measured in ETH, WBTC, LUSD, and DAI — not USD —, the backed floor price of each AQ1 does not fall below its current value. For example, if each 0,1% stake in the Treasury backing 1:1 the floor price of each AQ1 currently equals 0.3 ETH, 0.06 WBTC, 400 LUSD, and 400 DAI, it's guaranteed that such quantity of each underlying asset is the current *Protocol Ensured Value (PEV)* of each AQ1, not falling below.

Such sums of ETH, WBTC, LUSD, and DAI collateralizing 1:1 the backed floor price of each AQ1 stays fully stable since Aliquo does not market sell the Treasury's balance sheet. Thus, *Protocol Ensured Value (PEV)* maintains or increases (i.e., compound) the backed floor price of AQ1.

$$PEV = \frac{a_1}{AQ1_{SC}} + \frac{a_2}{AQ1_{SC}} + \frac{a_3}{AQ1_{SC}} + \frac{a_4}{AQ1_{SC}}$$

- *Protocol Ensured Value* of each AQ1 can be verified by dividing individually the quantity of each underlying asset held at the Treasury by 1,000.

- This means PEV denotes *Protocol Ensured Value*, a_1, a_2, a_3, and a_4 denote individually the quantity of each of the four underlying assets held at the Treasury, and $AQ1_{SC}$ denotes *AQ1 Supply Cap* (1,000).
- **Note:** $a_1 = ETH$, $a_2 = WBTC$, $a_3 = LUSD$, and $a_4 = DAI$.
- In the end, when calculating PEV, it becomes measured by *quantity* (e.g., 0.1 ETH = 0.1 ETH), not *value* (e.g., 0.1 ETH = $200), and the result is a unit of counting that comprises four individual quantities embedded.
  - e.g., PEV = 0.1 ETH + 0.01 WBTC + 200 DAI + 200 LUSD

3.6 Free-Floating

AQ1 is free-floating, meaning that each NFT is free to trade above 0,1% of the Treasury's assets value, at a *premium*.

Aliquo does not impose any upper limits on the price ceiling of AQ1. In other words, the exchange rate of AQ1 is allowed to float due to market forces without the intervention of Aliquo, and, on the other hand, always keeping a 0,1% stake in the Treasury that defines the *minimum price* of each AQ1.

3.7 Governance Token

AQ1 serves as the Aliquo's governance token via Aliquo DAO.

Aliquo DAO governs Aliquo and maintains the consistency of AQ1 by controlling Aliquo Treasury. The membership of Aliquo DAO is based on anyone holding at least one AQ1, meaning AQ1 token-holders are the decision-makers of Aliquo. In other words, AQ1 is an ERC-721 governance token that dictates Aliquo by AQ1 token-holders issuing and voting on governance proposals via Aliquo DAO.

Through Aliquo DAO, AQ1 token-holders run all governance decisions regarding Aliquo, which may include decisions around development, economic parameters, treasury management, or anything else the community judges as necessary for the proper fulfillment of Aliquo.

3.8 On-Chain Storage

AQ1 is generated and stored on-chain. No third-party servers become utilized to store the metadata and visual output of each AQ1; the Ethereum blockchain is the data store.

3.8.1   Visual Output

At the time of minting AQ1, a randomly generated string of 36 binary numbers made up of 0 and 1, divided into 6 rows, becomes engraved on each NFT visual output. Like a fingerprint, no two strings are the same, thus, no two AQ1 are the same — every NFT is 1/1.

- Example of an AQ1's binary string:

```
00 00 00 01 00 10
10 00 01 01 00 11
10 01 00 11 10 00
01 00 11 10 11 10
01 01 00 11 11 00
```

3.9   Royalties

AQ1 has 10% of royalties over secondary sales. Providing a mechanism of on-chain enforcement of these fees, `OperatorFilterRegistry` was implemented in the smart contract of AQ1[2].

3.9.1   Fees Distribution

100% of earnings from royalties over secondary sales of AQ1 becomes collected by Aliquo. The earnings are splitted as follow below:

- 9 of 10% is allocated to Aliquo Treasury

- 1 of 10% is dedicated to the protocol operation costs

Aliquo DAO can periodically propose to change the parameters of royalties fees distribution, and make adjustments that the decentralized organization sees best for the health of the protocol.

4   Dashboard

Aliquo's dashboard is a trusted and transparent reference point for AQ1, serving as a key tool to guide the AQ1 holders for token management. The dashboard's interface tracks and

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[2] https://github.com/ProjectOpenSea/operator-filter-registry

intersects multiple Aliquo-related data: **Treasury Assets Value**, **AQ1 Backed Floor Price**, **AQ1 Market Floor Price**, **AQ1 Market Cap**, **AQ1 Volume**, **AQ1 Royalties**, and more.

5   Flywheel

Aliquo introduces a flywheel mechanism that makes the protocol collect the earnings from royalties over secondary sales of AQ1 to reinvest in reserve assets, of which become employed to back the floor price of the NFTs themselves. This creates Aliquo's flywheel — the protocol's core mechanism.

5.1   Strategy

1. The increased trading of AQ1 leads to increased earnings from royalties over secondary sales;
2. Increased earnings from royalties over secondary sales increase the Treasury's balance sheet and, subsequently, increase the value of a 0,1% stake in the Treasury backing the floor price of AQ1;
3. The increase of the backed floor price of AQ1 generates, proportionally, leveraged earnings from royalties in each trade of AQ1 on the secondary market;
4. The cycle is completed and repeated perpetually.

5.1.1   Compound Interest

Through the flywheel mechanism, Aliquo adds biweekly the profit earned from royalties of the entire token supply of AQ1 back to the principal amount of the 1,000 NFTs; reinvesting the entire sum to accelerate the profit-earning process of all assets equally in the next cycle of compounding. Therefore, the current original principal of each AQ1 (i.e., current backed floor price) represents the accrual of all the interest earned and added from the previous cycles of compounding.

Aliquo's flywheel provides a long-term, virtuous cycle of compounding the backed floor price of AQ1: as much more AQ1 becomes traded, more earnings from royalties the protocol accumulate as backed value to AQ1 itself. Hereupon, the key point of compounding the floor price of AQ1 is that as much more the backed floor price increases, it proportionally leverages how much 10% from royalties equals in each secondary sale of AQ1; then, reflecting on the posterior protocol revenue and the next cycle of compounding.

It's correct to assume that each secondary sale of AQ1 affects the entire token supply, meaning that the interest earned from royalties in each secondary sale is diluted among the entire token supply of AQ1 (interest earned per secondary sale/1,000), not accruing individually the sum earned to the traded token. In other words, one secondary sale of AQ1 earns interest to the entire token supply.
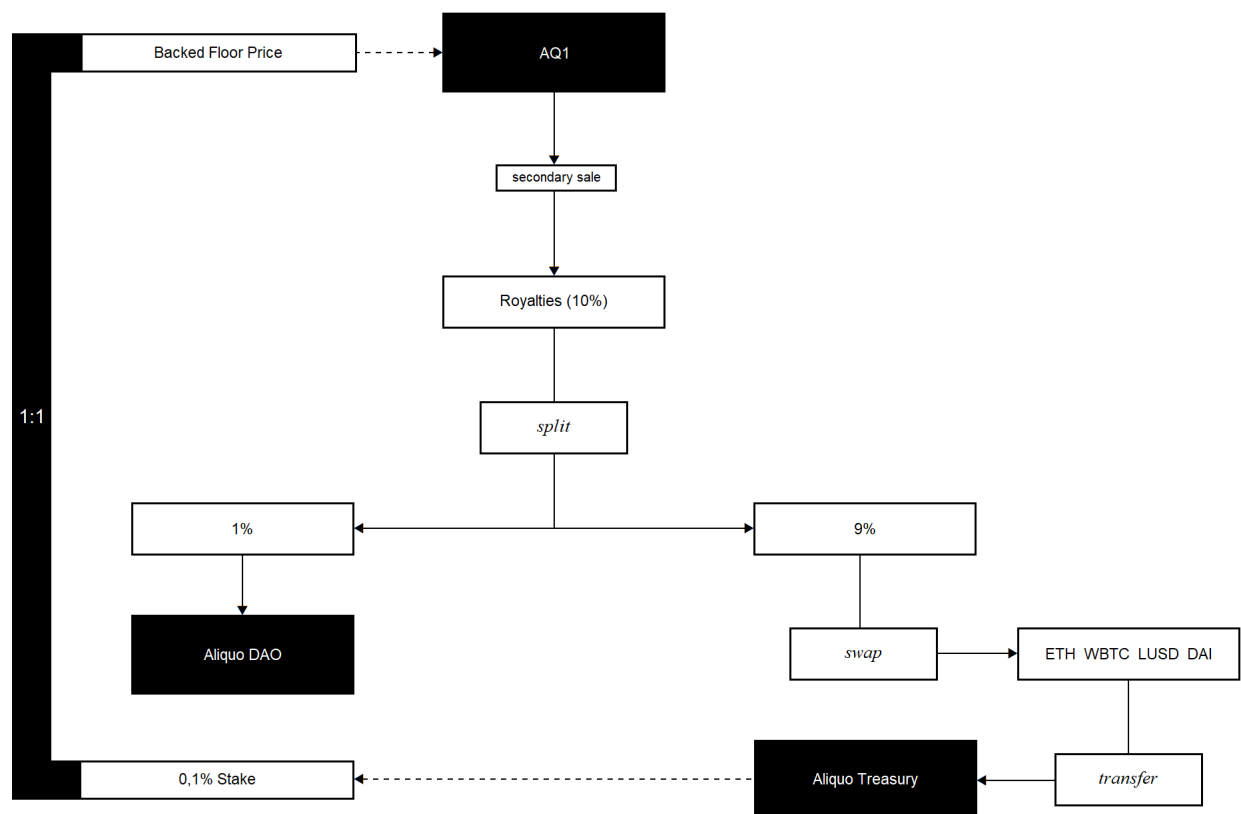
5.2   Architecture

Diagram of Aliquo's flywheel mechanism architecture

5.2.1   Mechanism

Aliquo's flywheel works as a structurally viable and economically sustainable mechanism that makes AQ1 accrue its liquidity, providing a long-term, virtuous cycle of compounding the backed floor price of the token itself.

1. When trading volume of AQ1 increases, earnings from royalties over secondary sales increase as well;
2. When earnings from royalties over secondary sales increase, the allocation for Treasury increases as well;
3. When allocation for Treasury increases, the backed floor price of AQ1 increases as well;
4. When the backed floor price of AQ1 increases, earnings from royalties over secondary sales in each secondary sale of AQ1 proportionally increase as well.

5.3 Operation

The royalties fees over secondary sales of AQ1 are collected in a primary wallet (Royalty Recipient). Then, the fees collected are transferred biweekly to a secondary wallet that executes the swapping of the funds on DEXes/CEXes. After the swap, ETH, WBTC, DAI, and LUSD are obtained and transferred to the Aliquo Treasury. The compounding events of AQ1 occur every two weeks.

Operations are transparent and traceable, executed on-chain by Multisig Members and supervised by Aliquo DAO.

6 Equations

6.1 AQ1 Backed Floor Price

$$AQ1_{backed} = \frac{TAV}{AQ1_{SC}}$$

- $AQ1_{backed}$ equals TAV divided by $AQ1_{SC}$, where $AQ1_{backed}$ denotes *AQ1 Backed Floor Price*, TAV denotes Treasury Assets Value (100%; measured in USD), and $AQ1_{SC}$ denotes AQ1 Supply Cap (1,000). This means *AQ1 Backed Floor Price* is always collateralized 1:1 by a 0,1% stake in the Treasury (100%/1,000).
- **Note:** It's aimed that *AQ1 Backed Floor Price* will be respected as the *minimum price* of AQ1 in the secondary market because token holders, being reasonably rational and self-interested agents, will always look to maximize their profits, as occurs with managing any other asset.

6.2   AQ1 Market Floor Price

$$AQ1_{market} = \frac{TAV}{AQ1_{SC}} + P$$

- $AQ1_{market}$ equals TAV divided by $AQ1_{SC}$ plus P, where $AQ1_{market}$ denotes *AQ1 Market Floor Price*, TAV denotes *Treasury Assets Value* (measured in USD), $AQ1_{SC}$ denotes *AQ1 Supply Cap* (1,000), and P denotes *premium*.
- **Note:** AQ1 is free-floating. The Aliquo Protocol does not impose any upper limits on the price ceiling of AQ1, meaning that AQ1 can always trade above its 0,1% stake in the Treasury, at a *premium*. *AQ1 Market Floor Price* is the floor price of AQ1 on marketplaces (OpenSea), which is dictated by market forces.

6.2.1   Premium

$$P = AQ1_{market} - AQ1_{backed}$$

- *Premium* equals the additional value of *AQ1 Market Floor Price* that exceeds *AQ1 Backed Floor Price*.
- e.g., If $AQ1_{market}$ is $200 and $AQ1_{backed}$ is $150, P equals $50.

7   Tokenomics

Token Symbol	AQ1
Blockchain	Ethereum
Token Standard	ERC-721
Total Supply	1,000
Output Storage	On-Chain
Output MIME Type	SVG
Governance Token	Yes
Royalty Fee	10%
Mint	1 per *tx*

7.1 Token Distribution

The launch of AQ1 is defined as a fair public launch, empowering the protocol decentralization since its inception. Through a fair public launch, the entire token supply of AQ1 is offered via public mint, in a single event.

There is no founder or development team, VC, or early investor pre-allocation program to privately claim a portion of the total supply of AQ1 before the release for sale to the public. Everyone, from everywhere, is allowed to mint AQ1 with equal opportunity.

8 Aliquo DAO

Aliquo DAO is the decentralized organization of AQ1 token-holders governing Aliquo.

The mission of Aliquo DAO is (1) to run Aliquo, (2) to ensure the consistency of AQ1 by managing the Aliquo Treasury, and (3) to promote the economic and social well-being of the community.

8.1 Decentralized Governance

Aliquo DAO is formed solely by AQ1 token-holders. Distributing the Aliquo's decision-making power in favor of the community, the membership of Aliquo DAO is based on holding 0,1% of the total supply of AQ1 (1 of 1,000 NFTs), meaning anyone having at least one AQ1 delegated to their wallet address is allowed to issue or vote on a governance action; any wallet address with at least one AQ1 can vote for or against any governance action.

8.2 Permissionless

Aliquo is permissionless. This means anyone holding AQ1 is allowed to join Aliquo DAO and participate in shaping the protocol's future.

8.3 Governance Structure

Aliquo DAO introduces a simple structure where any DAO member can issue a governance proposal, and every DAO member can vote democratically on every decision.

Aliquo DAO is governed through off-chain voting (Snapshot), with governance actions occurring on-chain by the Multisig Members, which are delegated by Aliquo DAO.

- **AQ1 Holders:** issue and vote for changes to the protocol

- **Multisig Members:** manage the Aliquo Treasury executing any on-chain decisions

8.4   Governance Infrastructure

The decentralized governance of Aliquo occurs via Forum and Snapshot. Discussions about governance proposals take place at the Forum. Then, once a governance proposal is debated at large by the community, it becomes introduced on Snapshot for voting.

8.5   Governance Process

Voting Weight	1 AQ1 equals 1 vote
Voting Threshold	1 AQ1
Proposal Threshold	1 AQ1
Voting Period	7 Days
Quorum	501 AQ1
Timelock	5 days

Aliquo DAO can propose to change the parameters of governance (voting delay, voting period, timelock), and make adjustments that the decentralized organization sees best for the management of the protocol.

8.6   Aliquo Improvement Proposals (AIPs)

As a protocol, Aliquo is developed by the Aliquo Improvement Proposal process. The AIP process provides an open venue and structure for collectively evaluating changes to Aliquo Protocol.

Any member of Aliquo DAO can write an AIP. The authors are responsible for building consensus within the community and documenting/addressing dissenting opinions about the AIP.

Aliquo Improvement Proposals (AIPs) are the way to:

- Propose new features for Aliquo Protocol and their rationale;
- Specify the implementation details of the feature;
- Collect community input on the proposal;
- Document design decisions;
- And more.

9 Aliquo Treasury

Aliquo Treasury is the protocol reserve backing the value of AQ1, safeguarded and managed by Aliquo DAO. The earnings from royalties over secondary sales of AQ1 are reinvested in ETH, WBTC, DAI, and LUSD and allocated to the Treasury.

Aliquo Treasury is fractionalized in 1,000 stakes with a theoretical ratio of 1:1 between the Treasury's assets value (100%) and the AQ1 supply cap (1,000), on which each stake (0,1%) collateralizes 1:1 the backed floor price of each NFT.

9.1 Treasury Management

Aliquo Treasury is dictated by Aliquo DAO through governance proposals. The protocol reserve is managed by Multisig Members via multi-signature authentication.

9.1.1 Transparency

The management of Aliquo Treasury is transparent as they are public records on the Ethereum blockchain, being decided by consensus through governance proposals via Aliquo DAO.

9.2 Treasury Gauges

Biweekly, Aliquo reinvests the collected earnings from royalties over secondary sales of AQ1 in ETH, WBTC, LUSD, and DAI, and allocates to the Aliquo Treasury. The proportion of reinvestment in each underlying asset is defined through AQ1 token-holders voting on *gauges* via Aliquo DAO.

For each *gauge*, a distinct proportion for the distribution of funds is proposed:

- Gauge 1 → 25% ETH; 25% WBTC; 25% LUSD; 25% DAI

- Gauge 2 → 10% ETH; 10% WBTC; 40% LUSD; 40% DAI

- Gauge 3 → 35% ETH; 35% WBTC; 15% LUSD; 15% DAI

9.3   Proof of Reserve (PoR)

Proof of Reserve (PoR) is the method to audit and attest the Treasury's assets value. Mirroring *Proof of Value (PoV)*, *Proof of Reserve (PoR)* works as a due diligence where anyone can verify the Treasury's assets value in the root, tracking on block explorers the wallet address that holds the funds.

It's correct to assume that while *Proof of Value (PoV)* is a token feature of AQ1, *Proof of Reserve (PoR)* is a protocol feature of Aliquo, with both *PoV* and *PoR* providing the same goal: transparency and trust for stakeholders.

$$PoR = a_1 + a_2 + a_3 + a_4$$

- PoR denotes *Proof of Reserve*, and a_1, a_2, a_3, and a_4 denote individually the value (measured in USD) of the allocation of each of the four underlying assets held in the Treasury ($a_1 = ETH$, $a_2 = WBTC$, $a_3 = LUSD$, and $a_4 = DAI$). This means *Proof of Reserve* is attested by summing the value, measured in USD, of the allocation of each underlying asset held at the Aliquo Treasury.

9.4   Protocol-Owned Liquidity (POL)

Aliquo owns 100% of the liquidity collateralizing 1:1 the backed floor price of AQ1, which is fully held at the Treasury. 100% of the liquidity held at the Treasury comes from royalties over secondary sales of AQ1.

9.5   Treasury Composition

Distributing risk and improving liquidity, four crypto-assets are accrued at the Aliquo Treasury: Ether (ETH), Wrapped Bitcoin (WBTC), Dai (DAI), and Liquity USD (LUSD).

Envisioning the best for the health of the protocol, through *Aliquo Improvement Proposals (AIPs)*, Aliquo DAO can propose to change the Treasury Composition, removing or adding new underlying assets to the Treasury's balance sheet and defining the resulting parameters of such changes.

9.6 Safety of Funds

Aliquo DAO is responsible for the safety and security of protocol funds held at the Treasury. To ensure it, Treasury is governed by Aliquo DAO members and managed via multi-signature authentication by Multisig Members:

- The multi-signature authentication is formed of eight Multisig Members.
- Treasury is protected with a 5/8 multi-signature procedure, meaning for every transaction involving funds from the Aliquo Treasury, five Multisig Members, at least, need to sign the transaction.
- Multisig Members are delegated by Aliquo DAO.

10 Conclusion

Historically, people tend to hedge against inflation risks by investing or allocating capital to store of value assets that are expected to retain or increase their value.

Materializing the core utility of AQ1, Aliquo aims that the protocol-native token can function as a decentralized reserve asset that accrues earnings from royalties as backed value, enabling AQ1 to retain or increase its purchasing power over time, rather than depreciate; the primary fundamental of a reserve asset.