

Team CSAM

Tokenizing Closed- End Fund Shares

Blockchain Challenge

2022

CREDIT SUISSE 



University
of Basel

Center for
Innovative Finance

Executive Summary

Case - Credit Suisse Asset Management

This concept paper discusses the implementation of a blockchain-based marketplace for a closed-end fund operating in real estate, managed by Credit Suisse Asset Management Switzerland (CSAM).

The management of such a closed-end fund is a well-established process: The portfolio manager of CSAM is responsible for finding lucrative investment opportunities in real estate, raising the capital for the investments and managing the customer relationship with the investors. This concept paper focuses on closed-end funds in which only qualified investors can invest. These qualified investors usually invest their money intending to keep the investment for a relatively long period.

Although the management of such closed-end funds is well established, the administration of the transfer of shares is complicated. For example, if qualified investors want to leave the fund, the portfolio manager needs to find other qualified investors who invest the same amount of money to repay the qualified investors who are leaving the fund. This exchange is necessary because a profitable sale of real estate is often not possible on short notice. Our project paper proposes simplification of the current administration process.

Our first challenge is in regards to building a blockchain-based marketplace where tokenized shares can directly be traded between qualified investors.

The second challenge bases on this marketplace: The direct trade between qualified investors allows the introduction of a price mechanism in the market. For this purpose, we implement a Dutch Auction to enable a dynamic price finding strategy.

The third challenge we address concerns the liquidity management of closed-end funds. Both holding too much and too little cash in the fund is a risk for a successfully operating closed-end fund. The proposed solution allows the portfolio manager to raise additional capital quickly by issuing a market call on the blockchain: Newly minted and issued tokens can be sold to interested qualified investors directly in the marketplace.

A possible extension of our solution to the Decentralized Finance ecosystem is proposed and discussed in the last part of this concept paper. The extension allows us to exploit this quickly growing new financial market.



Marketplace Application

Scan the QR-Code or visit <https://cef-marketplace.vercel.app/> to access the marketplace application. The smart contract is deployed on the Ropsten testnet. In order to interact with the smart contract a wallet and test ether is needed.



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1. Introduction

Credit Suisse Asset Management Switzerland (CSAM) seeks to implement a blockchain-based marketplace where shares of a closed-end fund are tokenized. This concept paper discusses our solution to simplify the current workflow of managing closed-end funds. On this marketplace CSAM can tokenize part of their newly issued shares and allow qualified investors to trade their shares directly. In addition, the marketplace is designed to enable future connectivity to the DeFi ecosystem. It is motivated by the potential future opportunities in the DeFi space, in which new financial products are being developed that add additional value for qualified investors and CSAM. This chapter describes the current workflow and the three main challenges of such closed-end funds.

Characteristics of a Closed-End Fund

A closed-end fund typically invests in highly illiquid markets. In this concept paper, the focus lies on closed-end funds investing in real estate. Illiquid markets are markets that operate in an environment where it is very difficult to sell assets in the short term according to their actual value. The real estate market is especially known to be characterized by very long transaction periods with high transaction costs. (Markheim & Berentsen, 2021)

Because of the underlying asset classes, closed-end funds generally have high minimum investment tickets. In the CSAM case, only qualified investors can pool their money into the fund and buy shares. Qualified investors are, for example, financial intermediaries, insurance companies, or

high-net-worth individuals. The definition varies from country to country. In Switzerland Art. 10 Para. 3 of the Swiss Federal Collective Investment Schemes Act (CISA) defines which financial actors are considered qualified investors.

Challenge 1 - Transferring Shares

The first challenge concerns the time-consuming process of transferring shares from one qualified investor to another that needs to occur when one qualified investor wants to leave the fund. Since the money in the closed-end fund is invested in highly illiquid markets, the portfolio manager cannot sell assets to repay an investor who wants to leave the fund. This is because the profitable sale of real estate is often not possible in the short run. For the case when qualified investors intend to leave the fund, the portfolio manager maintains an Excel-based waiting list of other qualified investors who are potentially interested in buying these shares.

How Shares are Transferred Today

CSAM informs qualified investors that are on the waiting list if shares become available. New shares either become available when the fund manager issues new shares or when qualified investors want to sell their shares. The process is illustrated in the graphic on the next page.

In this example, on one side, Bob, Claudia, and Alice are three qualified investors who are on the waiting list because they want to invest some of their money in the closed-end fund. Eric is in the possession of 10 shares and intends to sell them. To do so, he calls the portfolio manager to express his request.

After receiving this request, the portfolio manager needs to find other qualified investors. Based on the waiting list, the portfolio manager first calls Alice, the first qualified investor on the first position, and offers her the investment opportunity of 5 shares. The offer is 5 shares, as this is the default investment size under the fund's rules. In this example, Alice accepts the investment opportunity and the portfolio manager calls the next in line, Bob. Bob also accepts the offer of 5 shares. Since no more shares are available, Claudia has no opportunity to invest and has to wait until another investment opportunity arises.

Net Asset Value

The Net Asset Value (NAV) is defined as the fund's total assets less its liabilities. NAV, is often calculated as the per-share value of a mutual fund, ETF, or closed-end fund. Later in this paper we talk about the net asset value per token of a closed-end fund.



Once a new investment opportunity arises, Claudia will be the first on the waiting list.

CSAM uses these distribution rules to guarantee equal opportunities for all investors. In this example, this implies that a qualified investor on the waiting list can only buy 5 shares. The current price at which investors sell and buy shares is defined by the Net Asset Value (NAV).

Challenge 2 - Price Mechanism

The second challenge that CSAM faces is actually an opportunity. In the process of transferring shares, we see an opportunity to implement a price mechanism with the objective to make the waiting list obsolete. Contrary to the waiting list, where the price for a share is determined by the NAV, the price depends on what buyers are willing to pay.

Challenge 3 - Finding Investment Opportunity

Another problem CSAM faces is a trade-off between having too much or too little cash on the balance sheet. If the fund holds too much cash, the performance gets diluted and if the fund holds too little cash the portfolio manager faces the risk of not being able to execute investments on time when a good investment opportunity opens up.

Research Question

Derived from the challenges we formulated the following research questions

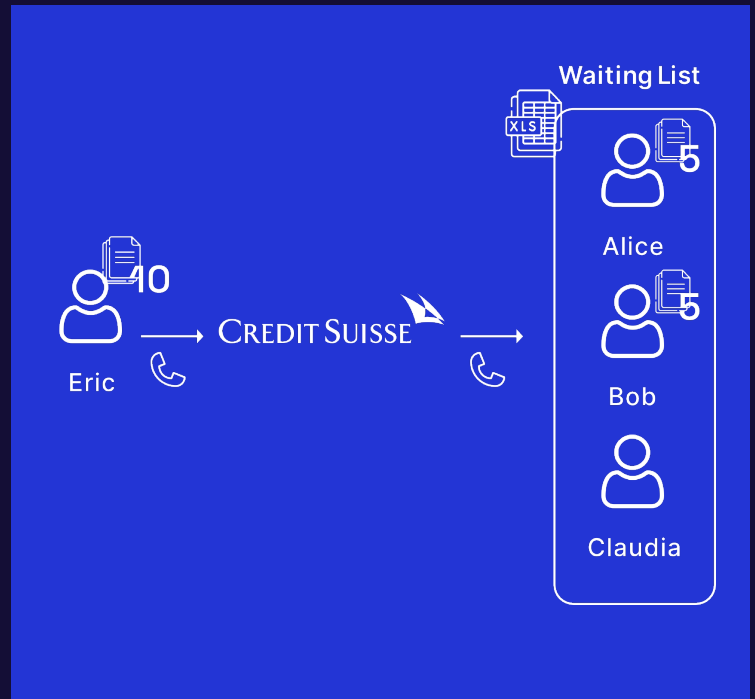


Figure 1: Illustration Waiting List

01

Admin Effort

How to make closed-end fund shares transferable using blockchain technology to minimize admin effort?

02

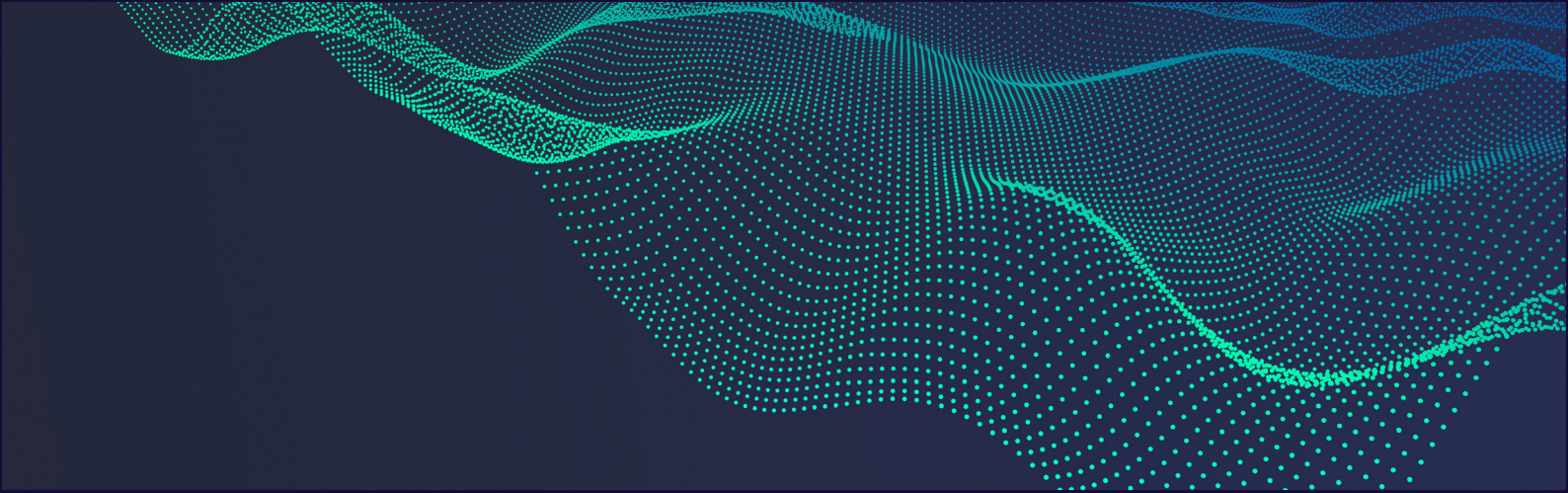
Price Mechanism

How to replace the waiting list with a price mechanism when trading shares?

03

Extension

How can we extend the marketplace using blockchain technology to generate value for the investor as a token holder?



2. Ecosystem

This chapter introduces the reader to the topics of tokenization and decentralized finance (DeFi). We then offer an overview of the ecosystem and provide information on the legal background surrounding the offering of tokenized shares in Switzerland.

Introducing Tokenization

Tokenization is the process of making assets such as real estate available on public blockchains. Public blockchains allow participants to establish a shared and immutable record of ownership on a common ledger. By tokenizing shares of the closed-end fund on a smart contract, trading the tokens becomes more accessible and more efficient as the tokens can be transferred within seconds from one investor to another. Furthermore, the process is secured through the implementation of the public ledger. (Schär, 2021)

An important backbone of tokenization are smart contracts. These are small programs stored on the blockchain. They are automatically executed if a certain condition is reached. For example, a buy order for shares can

be encoded in a smart contract. This smart-contract is executed if the shares become available at a predetermined price. If the smart-contracts are stored on a public blockchain, anyone can inspect these contracts and verify that they are executed in a correct way. (Schär, 2021)

Introducing Decentralized Finance

DeFi describes an alternative financial infrastructure. In DeFi, the range and options of service available do not differ substantially from the traditional financial infrastructure. The financial infrastructure is built on top of a blockchain like Ethereum and uses smart contracts to replicate existing financial services. The replication of the traditional financial services by smart contracts makes these financial services more transparent and open than in the traditional banking system. Further, transactions become independent of intermediaries and centralized institutions since DeFi is based on open protocols and decentralized applications. (Schär, 2021)

DeFi

72.7B USD

The total value locked in decentralized finance in 2022. (DeFi Pulse, 2022)

.....

DeFi

700B USD

In Mai 2020 the market capitalization of Bitcoin was over 700 billion USD. (CoinMarketCap, 2022)



Access

Provision of access to DeFi services for individuals with more robust customer service and a secure custody solution.



Trust

Participation in governance to add a layer of assurance that protocols are operating effectively and efficiently.



Liquidity

Provision of liquidity to protocols as a source of revenue or leverage protocols to manage liquidity needs.



Innovation

Build on and improve existing protocols and services offered by utilizing industry knowledge and expertise.

Source: EY, 2021a

Stakeholders

The whole ecosystem consists of three stakeholders: the qualified investors, portfolio managers of CSAM and the regulatory authority. Switzerland's Federal Act on Collective Investment Schemes defines qualified investors as regulated financial intermediaries such as banks, securities traders, fund management companies, or insurance companies. Further, high net worth individuals and investors can declare themselves as institutional investors. (Böhme et al., 2015)

Legal Background in Switzerland

Due to the rising popularity of asset tokenization, the Federal Legislator decided to implement multiple laws in the past years. Therefore, we briefly introduce the laws relevant to tokenize shares in the CSAM case.

The Swiss Regulatory Authority FINMA analyzes each initial coin offering (ICO) individually on a case-by-case basis. An ICO is the process of creating coins and offering them for sale for the first time, similar to an initial public offering. Depending on how FINMA categorizes the tokens, different regulations apply. Based on research, we assume that the tokens created will be handled as security tokens. Security tokens are financial instruments which contain a promise of future payments and are therefore similar to ordinary shares. (Markheim & Berentsen, 2021)

In 2020, the existing law was slightly adapted as the Swiss parliament agreed on the Federal law to developments in distributed ledger technology (Swiss DLT Bill). Ever since the creation of tokens has been subject to the so-called "registration agreement" via a ledger-based register that must fulfil certain material requirements that are stated in the Swiss Code of Obligations (Art. 973d para. 2 items 1 – 4 Swiss Code of Obligations; EY, 2021b; FINMA 2022) With the implementation of a state of the art blockchain, we ensure all material requirements to issue security tokens of this law are met.

Closed-End Funds

279B USD

In 2020 all closed-end funds together were valued at 279 billion USD. (Investment Company Institute, 2021)



Other Solution with Comparable Use-Cases

Token-as-a-Service

The first tokenized closed-end fund Token-as-a-Service (TaaS), operated from 2017 until it closed in 2019. The assets were redistributed to token owners who profited from an estimated 220 percent return on investment. It was also the first blockchain fund to provide full transparency about its contributions and partnerships and released detailed reports like a publicly-traded company would have to. TaaS invested the money in on-chain assets and not in off-chain asset classes such as real estate. (TAAS, 2022)

Singapore DBS Bank

In June 2021 the Singapore DBS bank initiated its first security token offering (STO) of a bond using blockchain technology. The bank stated that the digital bond grants investors the same rights as traditional bonds. Further, the securities are available for secondary trading among institutional and accredited investors who are members of the bank's digital exchange. (CoinDesk, 2021)

Tezos DAR-1 Standard

In August 2021 Inacta Information Management released a new token standard for the Tezos blockchain. DAR-1 contains functions needed to support smart contracts for lending money in the DeFi space. It was used by Swiss company InCore Bank to release industrial-grade storage, staking and trading services. This enables institutional investors to store cryptocurrencies, trade them and earn rewards generated by the blockchain. (SOBACO InCore, 2021)

3. Technology Selection Exploiting the Blockchain

Blockchain vs. Traditional Database

A traditional database could be used to create a secure and relatively efficient marketplace. However, since we want to connect the marketplace to the DeFi space, it is crucial that the marketplace is built using blockchain technology. Having our code and data on the blockchain has the additional benefits of immutability and transparency.

Ethereum

Since the number of qualified investors is limited and the expected transaction volume is comparatively low, energy demand and transactions per minute - and thus the choice of consensus algorithm - is not of primary importance. Ethereum satisfies our requirements regarding ledger type, has a stable consensus algorithm and also a massive market share, as well as a lot of different token standards. Further, the amount of established DeFi vehicles to which we can connect our fund is already quite impressive. Based on this argumentation we decided to build the marketplace on the Ethereum blockchain. (Schär, 2021)

Private vs. Public Ledger

To ensure a transparent and open-access solution that creates trust, increases traceability and is open to innovation, we propose the implementation of a public ledger. The proposed solution must adhere to Swiss law, for example, it must ensure that the ledger is immutable and that customers can view relevant information and ledger entries without any intervention by a third party. This stands also in favor of a public ledger.

Token Standard

A token standard is a set of rules which specifies what functions a token must support. Additional functions can be added while staying compliant with the standard. Using an established token standard ensures compatibility with existing blockchains and DeFi protocols. There are basic standards like ERC-20, which are used by the vast majority of smart contracts on the Ethereum blockchain. There are also standards that are based on ERC-20, with additional functions for a specific use case. One example is the ERC-1400 standard, a standard specifically for security tokens. However, this standard is too specific for the proposed solution and would introduce design constraints. This is also why we decided against the use of the Polymesh blockchain, with its ERC-1400 inspired token standard. By choosing ERC-20, we ensure compatibility with the DeFi ecosystem while having the freedom of tailoring it to our specific needs. (Schär, 2021)

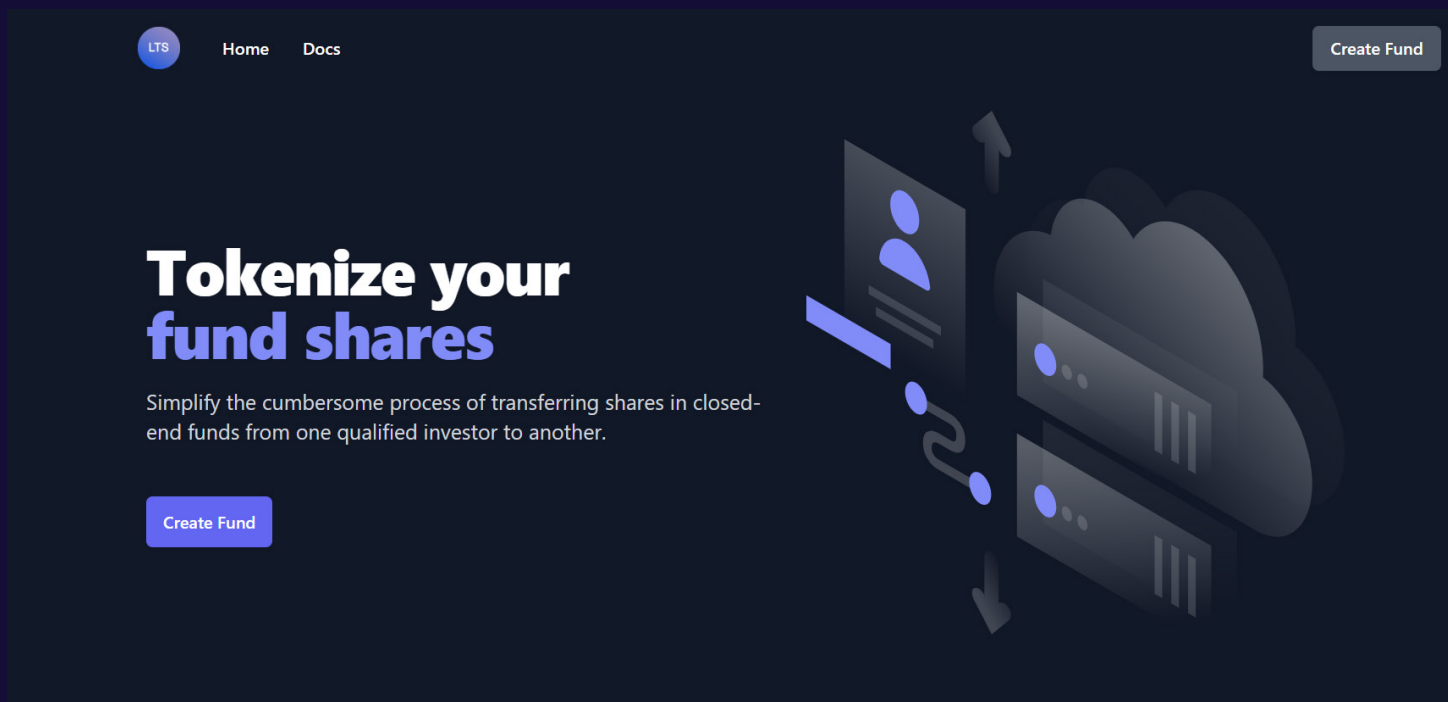


Figure 2: Mockup Landing Page

Solution

We used blockchain technology to create a marketplace where tokenized closed-end fund shares can be traded among qualified investors. The creation of this marketplace creates benefits for all the stakeholders involved.

Benefits

Investor

- Trade 24/7
- Use DeFi Protocols
- Access Short Term Liquidity

Benefits

CSAM

- Lower Administration Cost
- Early Adopter Benefits

Benefits

Regulatory Authority

- Transparent Transaction

Portfolio Manager

Create Fund	Possibility to create new funds.
Manage White-List	Add and remove qualified investors from fund.
Choose Price Mechanism	Decide between Dutch Auction or Waiting List Mechanism.
Issue Tokens/Shares	Mint initial and new tokens, when further capital is needed.
Set Tokenprice	Set price of issued tokens.
Set Tokencap	Define amount of tokens a qualified investors can buy at once.
Set Timeslot	Decide how long investor has time to decide whether to buy.
Withdraw	Possibility to withdraw money from the fund.

Qualified Investor

Trade Tokens	Buy and sell tokens in marketplace.
Buy Issued Tokens	Buy issued tokens directly from portfolio manager.
Check Token Balance	Option to check token balance.
Check White-List	Option to check if white-listed.

Table 1: Minimum Requirement Specifications with Description

Requirement Specs

The listed requirement specifications are the basis of the smart contract we built to minimize admin effort for the portfolio manager and to implement a pricing mechanism.

Creating a Fund

A portfolio manager has the following functionalities to create a fund with tokenized shares.

01

Title & Description

To create a new tokenized fund, the portfolio manager must name the fund and provide a description.

03

Mint Tokens

The portfolio manager chooses the number of tokens that the fund will issue and sets the price at which these tokens can be purchased for the first time. The amount of tokens and the price per token determine how much capital is raised when the tokens are first issued.

02

Price Mechanism

To guarantee future trading in the marketplace, the portfolio manager must decide which price mechanism is implemented. It is possible to introduce either a waiting list or a dutch auction.

04

White-List

The portfolio manager is in charge of actively managing the white-list. Only qualified investors on the white-list can interact with the fund. Qualified investors can be added and removed dynamically.

LTS

1. Title and Description

Please provide a title and a description of the fund you plan to deploy.

Title of Fund

Description

Write a few sentences about the fund.

2. Price Mechanism

Decide whether you want to use a waiting list mechanism or a dutch auction.

Mechanism

Waiting List

You are about to create a fund with a waiting list

Please, give additional information regarding waiting list.

Token Cap ?

Time Slot ?

h

3. Minting

Decide how many tokens to issue.

Token Price ?


ETH

Amount of Tokens

4. White-Listing

Please paste the addresses of your white-listed investors in the correct order.

Add White-listed Investor

 0x...

+ Add

Deploy Fund

Figure 3: Mockup Fund Creation

How to tokenize a fraction of shares?

Today the closed-end funds are managed off-chain only meaning that investors can only hold shares. As soon as the tokenization of shares becomes possible, CSAM must ensure that "double-owning" of shares, so having the same shares on-chain and off-chain, is impossible. We present three possible scenarios and solutions to prevent the double-owning issue.

01

In the first scenario, we discuss a possible tokenization when a new fund is created. In this case, the portfolio manager can decide to issue part of the shares on-chain as so called tokens.

02

The second scenario addresses the capital call of an existing fund. Instead of issuing additional off-chain shares, the portfolio manager has the option to raise capital by issuing tokens.

03

The third scenario enables qualified investors who already hold shares to exchange existing shares for tokens. The portfolio manager can initiate this exchange by invalidating the existing shares of the investor and issuing the same amount of tokens instead with a simple ERC20 transfer function on the smart contract.

```
1 contract CEFToken is ERC20 {
2     constructor(address _manager, uint256 initialSupply)
3         ERC20("CEF TOKEN", "CEF")
4     {
5         _mint(_manager, initialSupply);
6     }
7 }
8
9 contract ClosedEndFund is CEFToken {
10     ...
11     constructor(
12         address _manager,
13         string memory _title,
14         string memory _description,
15         uint256 _tokenPrice,
16         uint256 _initialSupply,
17         uint256 _tokensPerInvestor,
18         bool _isDutchAuction,
19         uint256 _timeToBuyInHours,
20         address[] memory _whiteListedInvestors
21     ) CEFToken(_manager, _initialSupply) {
22         manager = _manager;
23         title = _title;
24         description = _description;
25         tokenPrice = _tokenPrice;
26         tokensPerInvestor = _tokensPerInvestor;
27         isDutchAuction = _isDutchAuction;
28         timeToBuyInHours = _timeToBuyInHours;
29         startDate = block.timestamp;
30         waitingList = _whiteListedInvestors;
31
32         // add investors to mapping (whitelisting) - O(n) linear algorithm
33         for (uint256 i = 0; i < _whiteListedInvestors.length; i++) {
34             address whiteListedInvestor = _whiteListedInvestors[i];
35             whiteListedInvestors[whiteListedInvestor].whiteListed = true;
36         }
37     }
38     ...
39 }
```

Figure 4: Code Constructor

Technical Insights

Pressing the button "Deploy Fund" at the end of the creation form with all parameters provided, triggers the constructor function which creates an instance of a new smart-contract. This smart-contract represents the fund. The basis of this smart contract is the ERC20 contract from OpenZeppelin, a crypto cybersecurity technology and services company. Our smart contract inherits all the functionalities from the ERC20 contract, which is crucial to represent shares as tokens. A token expresses a unit of value which is assigned to an address in a blockchain database.

We further provide a detailed description of all variables and functions on our web application <https://cef-marketplace.vercel.app/docs>. Additionally, anyone can inspect the source code on github <https://github.com/tuncpolat/cef-marketplace>.

Price Mechanism

How trading Works On-Chain

Waiting List

When new tokens are available, either because the fund manager issues new tokens or because a qualified investor sells tokens, all qualified investors on the waiting list can buy the tokens. The investors receive the option to buy the tokens in order of their position on the waiting list.

The adaptation of the waiting list uses time components to determine which qualified investor is on the first position. A qualified investor who decides to buy a token available in the fund, sends a transaction through the smart contract using Ether. The waiting list on-chain uses the index of the qualified investor on the waiting list, the length of the waiting list, the actual time, the start-time and the time slot of the waiting list to check if this qualified investor is allowed to buy at this point in time.

```
72 function buyWaitingListToken(uint256 index, uint256 _amountOfTokens)
73     public
74     payable
75     isWhitelisted(msg.sender)
76     isWaitingList
77     returns (uint256 tokenAmount)
78 {
79     Selling storage selling = sellings[index]; // access selling; storage because need t
80     require(!selling.completed, "This selling is completed");
81     require(
82         tokensPerInvestor >= _amountOfTokens,
83         "Tokens per investor cap exceeded"
84     );
85     require(msg.value > 0, "Send ETH to buy some tokens");
86     require(
87         msg.value == _amountOfTokens * tokenPrice,
88         "Send right amount of ETH for the tokens"
89     );
90
91     // check investors balance
92     uint256 sellerBalance = this.balanceOf(selling.seller);
93     require(
94         sellerBalance >= _amountOfTokens,
95         "Seller has not enough tokens (anymore) in its balance"
96     );
97
98     // check waiting list position
99     int256 idx = findIndexInArray(msg.sender);
100    require(idx >= 0, "Investor is not found in waiting list");
101
102    // check time restriction
103    checkTimeRestriction(uint256(idx));
104
105    // after checks: allow to buy
106
107    // set time of buying for investor
108    whitelistedInvestors[msg.sender].timeLastBoughtTokens = block.timestamp;
109
110    // set completed to true if all tokens are sold
111    selling.amountToSell -= _amountOfTokens;
112    if (selling.amountToSell <= 0) {
113        selling.completed = true;
114    }
115
116    _transfer(selling.seller, msg.sender, _amountOfTokens); // Transfer token to the buy
117
118    emit BuyTokens(msg.sender, selling.seller, msg.value, _amountOfTokens); // emit the
119
120    payable(selling.seller).transfer(msg.value); // transfer (exact) money to seller
121
122    return (_amountOfTokens);
123 }
124 ...
125 }
```

Figure 5: Code Buy Waiting List

Automating Waiting List

With these lines of code we digitalize the manual and time-intensive management of the Excel-based waiting list.



Dutch Auction

A dutch auction is a dynamic pricing strategy in which the consumers actively determine the price. Qualified investors who want to sell their shares offer their shares at a higher price than buyers are willing to pay. The price is then gradually lowered until one of the white-listed qualified investors wants to buy the shares at the respective price. To secure the seller from a potential loss, we recommend that the seller sets the minimum price to the current NAV per token. If the price has reached the minimum price and no qualified investor bought the shares, the seller can revise the decision to sell the shares and eventually start the auction again.

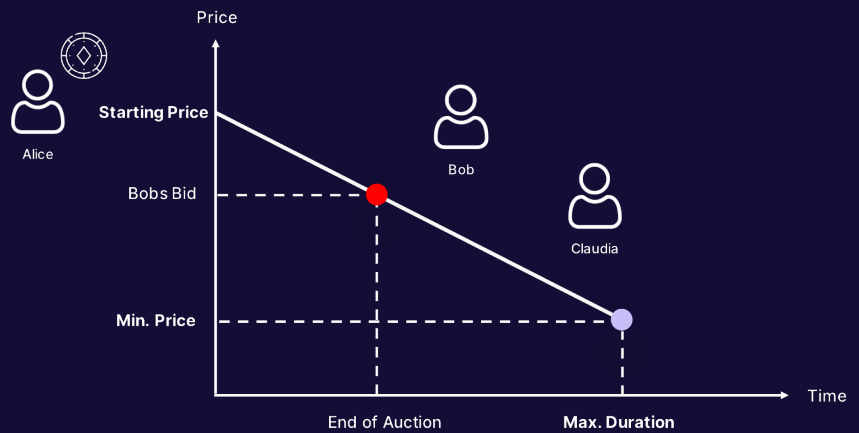


Figure 6: Dutch Auction

A dutch auction is a very efficient auction because the first-placed bid is also the winning bid, and the final price is generally higher than with other types of auctions. If no bid is placed until the minimum price is reached, the auction ends without a trade happening. (Marburger, 2015)

```

74 function buyAuctionToken(uint256 index) external payable isAuction {
75     Auction storage auction = auctions[index]; // access auction; storage because need to
76
77     require(!auction.completed, "This auction is completed");
78     require(block.timestamp < auction.expiresAt, "This auction has ended");
79
80     uint256 price = getAuctionPrice(index);
81     require(
82         msg.value >= price,
83         "The amount of ETH sent is less than the price of token"
84     );
85
86     auction.completed = true; // close auction
87
88     _transfer(auction.seller, msg.sender, auction.amountToSell); // transfer token
89
90     uint256 refund = msg.value - price;
91     if (refund > 0) {
92         payable(msg.sender).transfer(refund); // refund buyer if payed too much
93     }
94
95     payable(auction.seller).transfer(price); // transfer money to seller
96 }
97 ...
98 }
99

```

Figure 7: Code Buy Dutch Auction

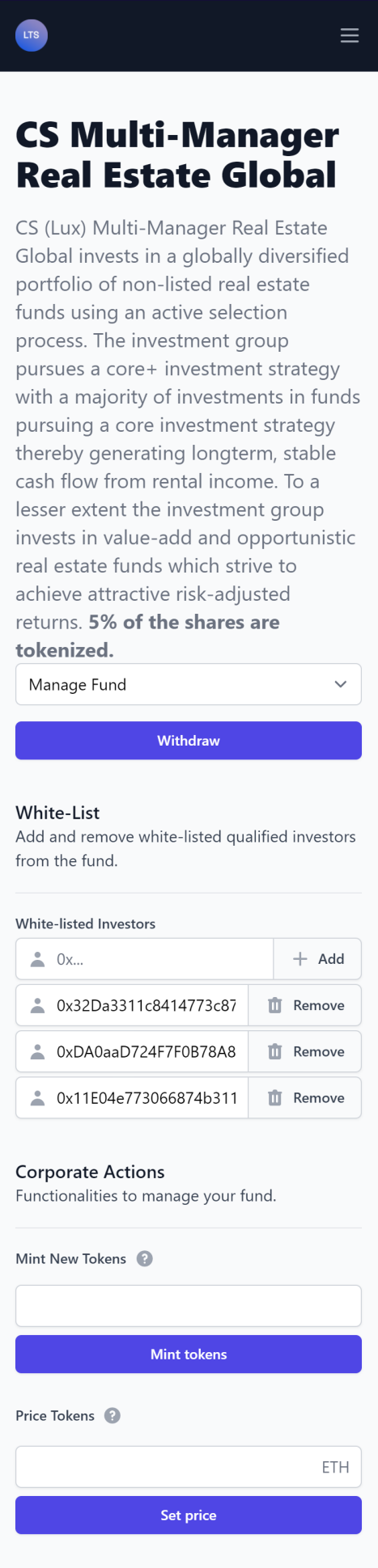


Figure 8: Mockup Manage Fund Dutch Auction

Manage a Fund as Portfolio Manager

Withdraw Money

After successfully creating a new fund, the portfolio manager must be able to withdraw unused money from the fund to fund new investments.

Manage White-List

For a portfolio manager it is necessary to have the possibility to manage the white-list once the fund is created. Qualified investors can be added and removed dynamically.

Issue Additional Tokens

If the qualified investor has an opportunity to execute an interesting investment opportunity, additional tokens can be issued to raise additional capital.

Token Price & Cap

The portfolio manager can decide at which price he wants to issue new tokens. In a waiting list fund, the portfolio manager has to update the NAV which determines the price of the tokens. The token cap can be changed dynamically to regulate how many tokens qualified investors on the waiting list can buy in one transaction.

Time Slot

The portfolio manager has the possibility to adapt the time slot of the waiting list.

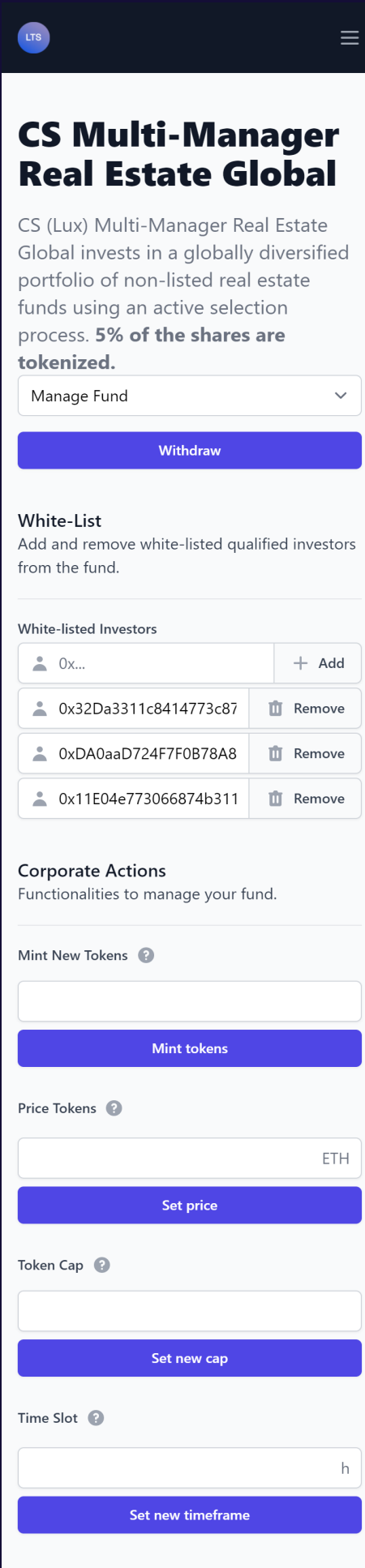


Figure 9: Mockup Manage Fund Waiting List

LTS

CS Multi-Manager Real Estate Global

CS (Lux) Multi-Manager Real Estate Global invests in a globally diversified portfolio of non-listed real estate funds using an active selection process. The investment group pursues a core+ investment strategy with a majority of investments in funds pursuing a core investment strategy thereby generating longterm, stable cash flow from rental income. To a lesser extent the investment group invests in value-add and opportunistic real estate funds which strive to achieve attractive risk-adjusted returns. **5% of the shares are tokenized.**

Manage Investment

Check Balance

Open Auctions

Currently available tokens - Please place your bid to buy your tokens from other qualified investors.

Seller Open

0xAb8483F64d9C6d1EcF9b849Ae677dD3315...

Starting Price Per Token

2 ETH

Mimimum Price Per Token

0.05 ETH

Expires at

2022-04-25 12:00:00

Amount of Tokens for Sale

5 Tokens

Current Price

Get current price

Make a bid

Buy Tokens

Enter the amount of tokens you want to buy directly from the fund manager.

Calculate Token Price ?

Amount of Tokens

Total Price

2 ETH

Buy Tokens

Start your Auction

Start your own auction to sell your tokens to other qualified investors.

Amount of Tokens to Sell

Starting Price ?

ETH

Minimum Price ?

ETH

Expiration Date ?

20-04-2022

Start Auction

White-List

Check if you are white-listed.

Check White-Listed Address

Paste own address

Check Address

Figure 10: Mockup Manage Investment

Investing as Qualified Investor

Check Balance

The qualified investors have the possibility to check their token balance anytime.

Buy Tokens

A qualified investor can participate in a dutch auction to buy tokens from other qualified investors. To buy from a waiting list, a qualified investor needs to be the first on the waiting list.

Sell Tokens

In order to sell tokens a qualified investors can start a dutch auction. To sell tokens in a waiting list based fund, the qualified investors have to voice their intention to sell to the fund manager.

Check White-List

Investors can check whether or not they are currently whitelisted.

Further Development

The smart contract features presented in the previous pages are a valuable mockup that addresses and solves the main problems presented in this concept paper. We propose three additional functionalities that further improve our mockup solution.

Document Management

Another interesting possibility that comes with a blockchain lies in the possibility of saving documents. For example, the rules of the fund on a distributed file system like IPFS. For these documents, we generate a cryptographic hash. This hash is saved on the blockchain and guarantees that the original file has not been tampered with.

In a further step, this can be extended to personal documents CSAM has to generate for its customers, like tax statements. Depending on the nature of the document, they can be public and transparent or private and encrypted. It must be ensured that the most recent versions of their documents are available to all qualified investors anytime.

External Audit

To provide even more trust among investors, giving external auditors the possibility of uploading their audits and the corresponding hashes can be beneficial. Existing and prospective investors can review the audits at any moment and make educated decisions about their investments.

Notification

To guarantee a pleasant user experience for qualified investors, developing further the notification sent out to qualified investors who are interested in the fund is important. For example, whenever a new dutch auction starts, a new token is available through the waiting list, or the portfolio manager plans to issue further tokens, a qualified investor should automatically receive an email. This feature helps to create attention when new tokens are for sale. The implementation of this feature must be encoded off-chain since smart contracts cannot send out events without an incoming transaction. They can only react based on incoming transactions. When the waiting list position changes, the smart contract cannot listen to these events and therefore, no automated message can be sent out.

Extension to DeFi Use Case Lending

As we mention in the introductory chapter, many traditional financial transactions can be done in the DeFi ecosystem. We will be focusing on lending, because it provides investors with a possibility to use their CSAM token as collateral for short-term cash needs while staying in the CSAM fund long-term.

To borrow money in a DeFi lending protocol the user has to deposit a collateral like a token or coin in a lending protocol. He can then obtain a crypto loan, which he has to repay with interest after a certain amount of time. If he does so, he gets his collateral back. If not, his collateral gets liquidated with the earnings used to pay the loan.

Benefits

For the investors this has the benefit that their investment does not just earn dividends, but that they can actively use their asset as collateral. CSAM profits by offering their customers more use cases for their tokens, thus making the fund more interesting for investors.

Problems and Limitations

Know your Customer (KYC)

The main obstacle to implementing this strategy is the regulatory aspect of "know your customer". KYC means that a financial institution like CSAM does have to know the identity of its clients to ensure that they are allowed to do financial transactions. This is ensured for all CSAM investors.

However, as soon as a token is used as collateral, the compliance with KYC is eroded: If an investor can't pay back the

cryptocurrency he borrowed against his CSAM tokens, this collateral gets liquidated on the blockchain. Since we don't know the identity of the new owner of the CSAM tokens, we can't ensure the KYC rule anymore.

There are two solutions to this problem. If the KYC regulations get loosened, this DeFi extension can be used. It is however highly unlikely that KYC regulations are loosened, especially in regards to DeFi. But what if we can ensure that all potential buyers are white-listed? It is unrealistic that CSAM can do the KYC themselves for every DeFi user. But if we can make sure that only a select group of DeFi users can buy CSAM tokens, doing KYC for all of them is doable.

Protocol acceptance

For CSAM tokens to be usable as collateral in DeFi lending they must be accepted in DeFi protocols, otherwise no financial transactions are possible. The challenge is to be able to give investors a selection of trustworthy protocols that accept CSAM tokens as collateral. Different DeFi protocols have different rules for which tokens or coins can be used as collateral.

There are protocols like UniLend, which accept any ERC-20 compliant token, like CSAM token, as collateral. Other protocols like Aave on the other hand only accept a selection of about 30 coins and tokens and there is a rigorous process before they add a new token. Another option would be to copy an existing Lending Protocol and add support for CSAM token. This however would mean that CSAM has to convince a sufficiently large portion of DeFi users to use this new protocol.

The Oracle Problem

Blockchains can't directly know what happens in the off-chain world. They rely on external services that aggregate information from the real-life world. These so-called oracles add vulnerability to the system. Malicious actors can try to use oracles to inject falsified information in order to influence the price of crypto assets. Centralized oracle networks go against the idea of DeFi, and pose a risk from the people or institutions controlling them. Solutions like decentralized oracle networks try to mitigate these attack vectors.

The Oracle Problem also applies to our DeFi integration solution: It needs off-chain data to determine the price of CSAM token. It must be ensured that the sources of this data is neutral and can't be trifled with by malicious actors. (Chainlink, 2020)

Possible Solution: Protocol based on Aave Arc

Aave Arc is a version of the Aave V2 DeFi protocol incorporating additional smart contracts for whitelisting users. Source: Aave Arc Whitepaper Aave Arc has the same functionalities as Aave where it is possible to lend, borrow and stake crypto assets. External Companies carry out the whitelisting of financial institutions like Banks, Hedge Funds or Asset Managers. Once whitelisted, these institutions can do DeFi transactions with other whitelisted institutions.

Aave, and therefore Aave Arc, supports only about 30 tokens and coins and has a rigorous process before adding a new token or coin. Because CSAM Token would be relatively small, we don't think it is likely that it will be supported by Aave Arc. However, the structure of Aave Arc

provides a possible solution for both the KYC and protocol acceptance problem that CSAM faces.

In our imagined C-Protocol the institutions like banks or asset managers become the whelisters and whelister their own, existing customers for access to the C-Protocol. In the end we have a number of trustworthy whelisters who have little more effort, since they have to do KYC diligence on their customers anyway.

Allowed assets on this Protocol should not only be a limited number of the most important cryptocurrencies like ETH or BTC, but also tokens issued by the whelisting institutions. This would solve CSAM's problem of finding a trusted DeFi protocol that accepts CSAM Token and has a large enough user base.

CSAM can either decide to be the only whelisting organization, thus only CSAM customers would participate in C-Protocol, or they could approve other financial institutions as whelisters, which would increase the possible number of users.

While this C-Protocol does not yet exist, we believe that the need for permissioned protocols will lead to this kind of protocol. (Markheim & Berentsen, 2021)

Conclusion

Our blockchain based implementation enables the transfer of shares in the form of tokens in a simplified and automated way and therefore minimize admin effort substantially. We introduced the Dutch Auction as an alternative price finding mechanism to the established waiting list. Furthermore, the implementation can be connected to the DeFi ecosystem. We did this with the objective of exploiting the DeFi ecosystem and creating additional use cases for all stakeholders involved.

There exists a growing need for regulated decentralized finance products. Retail and institutional investors want to profit from the possibilities of DeFi, but also need to comply with laws and regulations. The advent of new, regulated DeFi protocols will increase adoption and liquidity. The biggest regulated DeFi Protocols, Aave Arc and Compound Treasury, were both created as modified copies of established protocols. In the future we expect that more protocols are built with KYC compliance in mind from the beginning.

Course of Action

For the course of action, we recommend that CSAM creates a prospectus of the proposed tokenized fund in order to get legal authorization from FINMA. With this approval the smart contract for the fund can be developed on the basis of the programmed prototype. This smart contract should then be audited by an external auditing firm specialized on smart contracts. When implemented, it will reduce the administrative effort and thus cost. Furthermore, portfolio manager can make capital calls faster in case an investment opportunity appears. Investors can trade their tokenized shares around the clock.

In a future step, CSAM should enable CSAM tokens to be used in other DeFi protocols. As we laid out in this paper, there are still regulatory and technical hurdles to implementing this part of our concept. The regulatory uncertainty will decrease in the medium term and regulated protocols supporting tokens like CSAM tokens will appear. Our solution is designed so that the connection to the DeFi ecosystem can be enabled with little effort.

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Blockchain Challenge

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Scan the QR-Code or visit <https://cef-marketplace.vercel.app/> to access the marketplace application. The smart contract is deployed on the Ropsten testnet. In order to interact with the smart contract a wallet and test ether is needed.

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