# White Paper

# A Novel DeFi 2.0 Composition Protocol for Derivatives - Aquo

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## 1.0 Abstract

## 2.0 Introduction

## 3.0 Challenges in Current DeFi Ecosystem

### 3.1 Liquidity

There is limited liquidity aggregation across DeFi protocols.

## 4.0 Understanding Compositions and DeFi 2.0

### 4.1 Compositions

DeFi composition has been considered in academic published papers and defined in terms of its scope and nature. Werner et al. [4] define compositions as new financial products or services in a Lego brick type of architecture. The Money Lego architecture was considered by Katona et al. [6] who discussed how complex interoperability based transactions could be constructed within DeFi. Gudgeon et al. considered DeFi composition in terms of new protocols from existing ones, also with a Lego approach [7]. This can also be a building blocks approach.

Kitzler et al. [5] researched composition in depth and concluded that a new derivatives protocol using compositions could be needed.

The actual execution in DeFi composition is via an execution tree or path in which multiple DeFi protocols are executed. Jensen at al. [8] confirmed the value of seamless integration when DeFi applications are on the same blockchain.

We consider Aquo to apply to the same blockchain only and we consider a “building blocks” approach.

### 4.2 DeFi 2.0

DeFi 2.0 has an evolving definition [2]. Binance academy defines this in terms of solving DeFi problems, e.g. related to liquidity, Thunder Core defines this as bringing complex financial instruments interacting with smart contracts, with a focus on DAOs and a new financial system [3].

There is little academic literature or research papers confirming a definition of DeFi 2.0 but the term DeFi: Finance 2.0 did appear in Werner at al.’s SoK [4] with a discussion considering key elements of DeFi to be non-custodial, permissionless, auditable and composable.

We consider the proposals under Aquo to be DeFi 2.0. We propose an architecture which fundamentally is:

- Interoperable across DeFi Protocols
- Permissionless
- Auditable
- Composable
- Based on DAOs
- Building complex or novel financial products thereby creating a new financial system

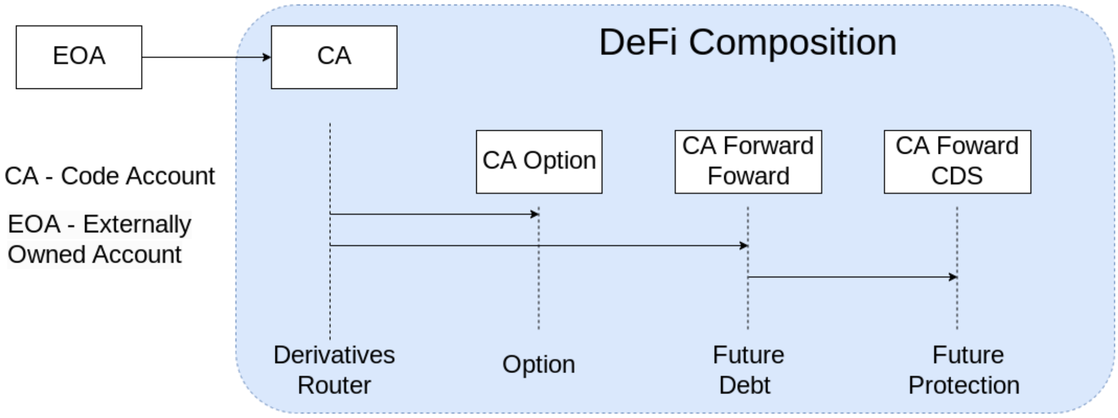
### 4.2 How compositions differ from traditional DeFi approaches

### 4.3 Benefits of composability for the DeFi ecosystem

## 5.0 Building Blocks of Compossibility

## 5.1 Building Blocks

We use the building blocks concepts derived from the Lego interpretation previously discussed. A building block is a DeFi protocol being invoked. An example is below:




In this example, the original CA integrates into other DeFi protocols, so that an EOA can buy an Option using a future debt with protection. The CAs are all on the same blockchain and hence this is a seamless integration.

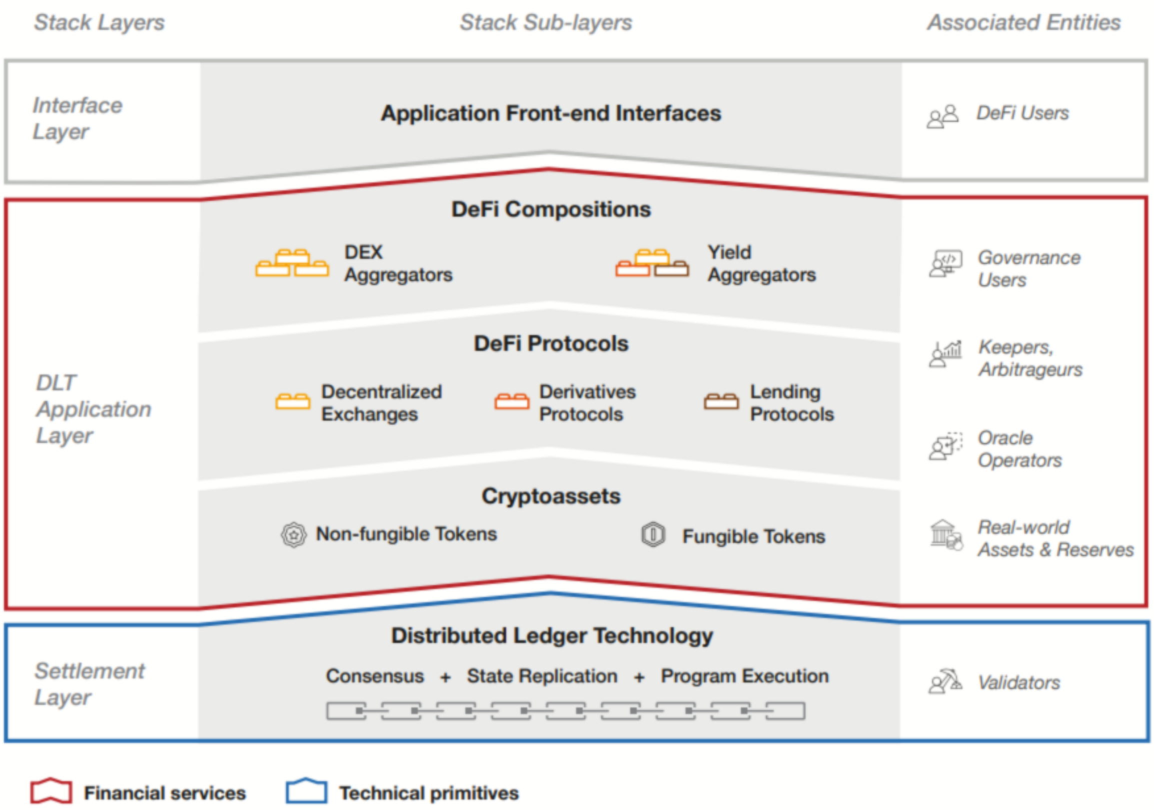
Hence, we could consider a tenant who lives in a house and agrees to rent the house with an option to buy it. This option takes into account market moves. The house is now valued at 400K USD and if the price moved to 500K then the tenant could buy it at 450K on an option. But he might not have the 450K and hence wants a future loan promise at the time of buying the option (forward forward) and then also wants to arrange loan protection should there be a default (variation on a CDS).

This can be completed via  DeFi composed transaction in which the option is purchased, the loan promised, and protection given. This is also innovative finance and we are not taking standard finance contracts, but tailoring contracts and creating new markets. Providing we have liquidity and can safeguard against counterparty defaults (via collateralization) then these new markets can develop.

# 6.0 Architecture of DeFi Compositions

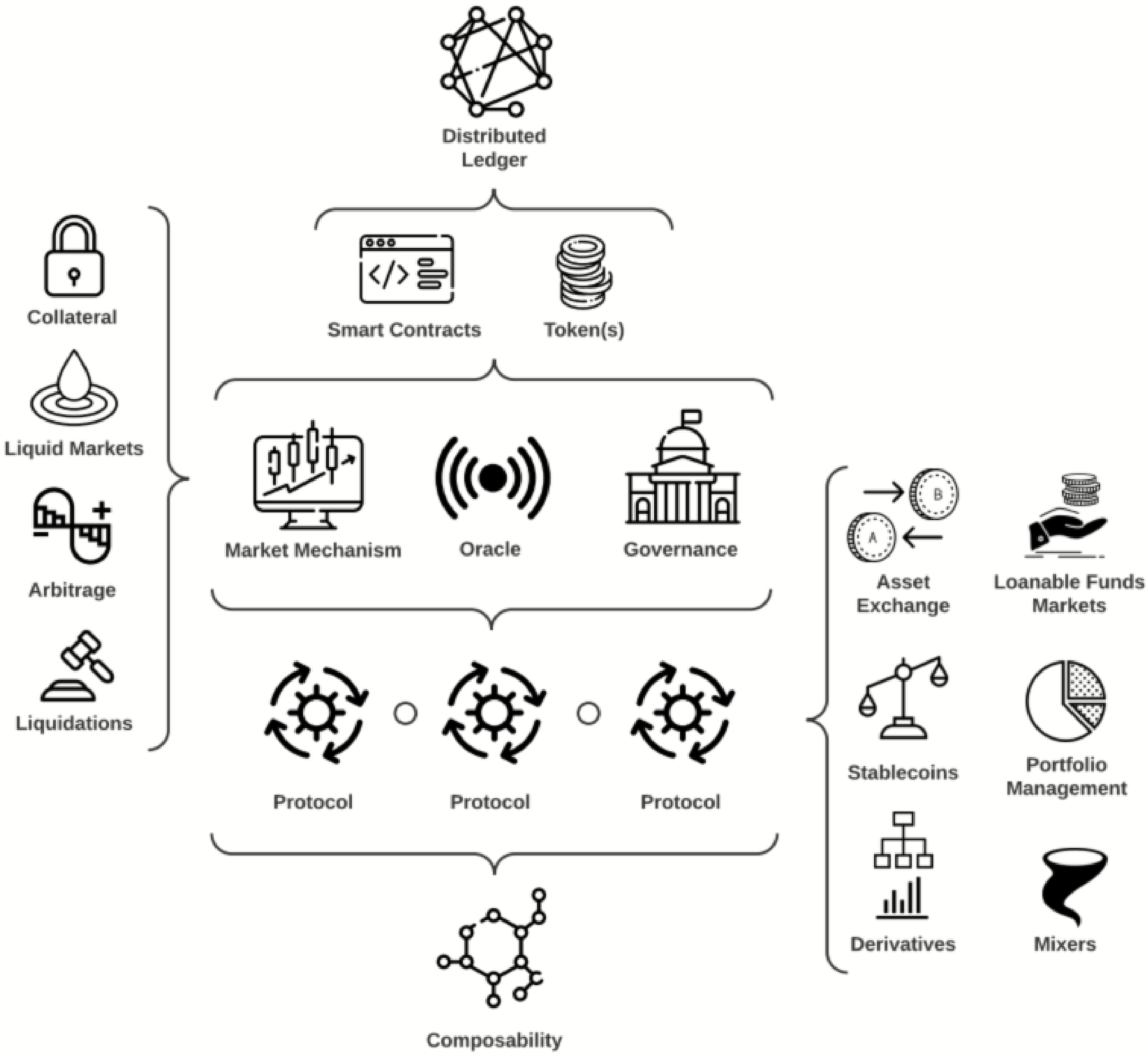
## 6.1 Existing Architectural Designs

Auer et al. [9] considered composability (shown below):




This layer structure is commonly seen in the literature. It shows how DeFi compositions access multiple DeFi protocols.

Werner et al. considered compositions as follows:




This shows a far wider meaning in accessing oracles, liquid markets, stablecoins, portfolio management, and derivatives.

# 7.0 Aquo Architecture

We consider the critical part of composition to be derivatives. No financial market can operate effectively without liquidity and we also consider liquidity pools to be critical to Aquo's architecture.

## 7.1 RWAs

Derivatives themselves are reliant on underlying assets, these are real-world assets (RWAs) or real-assets in financial terms. Due to the nature or RWAs decentralized oracles are needed to provide their prices which should be used in trading. If this were not done, the the token market cap could differ to the actual RWA value which could lead to asset stripping (sale of assets to make a profit as the value is less than the token market cap), or investor loss who bought tokens are a price higher than the actual RWA value.

Therefore, RWA tokens themselves (traded as synthetic assets) would only be traded at the oracle price. This is a stablecoin concept with the price pegged to the actual asset value.

## 7.2 Currency Forward Contracts and the USD

RWAs will have real value in local currencies (usually), there are exceptions e.g. oil. DeFi is a long way from stablecoins in the numerous currencies globally and even some major stablecoins have been unstable.

Hence we propose that RWAs are priced in USD regardless of their jurisdiction. The actual real asset would of course trade in the real economy and then a **currency forward contract** is needed to maintain the price, this is another derivative.

This example will explain how this works. A house is valued at 400K GBP and tokenized. Whatever agreements are reached by the contracting parties, they want to settle finally in GBP. But Aquo works via USD.

Therefore a currency exchange rate is agreed at the current one when the house is tokenized and then this same rate is guaranteed via a forward derivative. Therefore if the Forex market moved from 1.2 USD for 1 GBP to 1.3 USD for 1 GBP, the RWA investor has no loss.

The new derivative is simply fashioned from the normal derivatives markets with Bid/Asks and in this case different traders will hedge and speculate on currency which will then give rise to the RWA price protection.

## 7.3 Synthetic Assets

The use of synthetic assets is well established in DeFi [10]. In the context of derivatives and RWAs, the most essential use case is for synthetic assets to track the RWA price. Hence we have a tradable token based on the RWA. A synthetic asset is another derivative. It is a contract based on an underlying asset (the RWA).

The RWA is just tokenized via an SPV with NFTs [11]. These models with SPVs which are bankruptcy-remote and NFTs which are claims on shares in an SPV are well known. The regulatory certainty comes from the share itself being transferred to the NFT holder in the simplest model.

Synthetic assets extend the model so that synthetic assets are tradable and this creates liquidity without having to trade the actual NFTs. This is equivalent to how securities are settled without having the actual certificates but based on a digital transaction. There is a contractual claim by the synthetic asset to the underlying NFT which allows the NFT asset to be claimed by the synthetic asset holder.

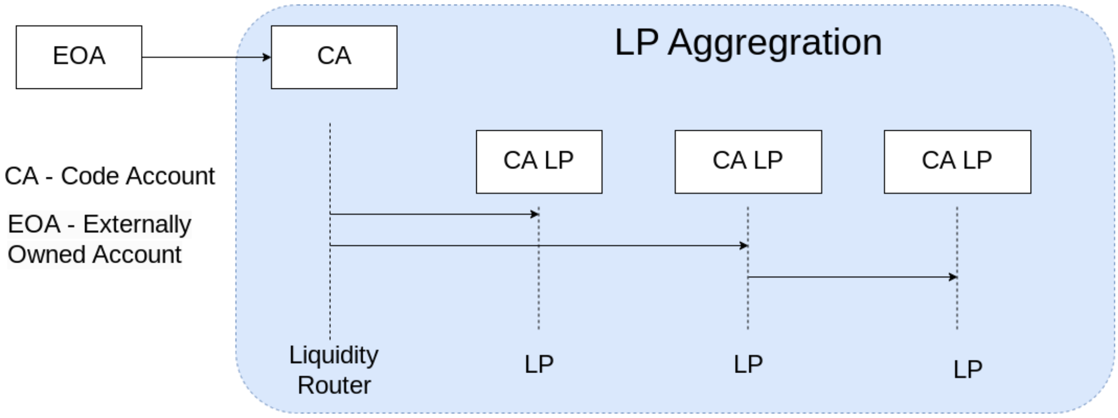
Tokenizing a RWA will not create liquidity unless the synthetic assets have a large market. That cannot happen unless the values are large. To avoid the problem of only tokenizing large assets, the actual synthetic assets would be the basis of liquidity pools (LPs) which would be aggregated as explained later. This then solves the liquidity problems. Also for this to work synthetic assets would be rated in a fashion akin to securities ratings today [12].

## 7.4 Oracles

Oracles are well established in DeFi and oracles would be used to feed prices.

## 7.4 Liquidity

Without liquidity the market will fail. One key aspect of Aquo is to allow liquidity to be aggregated via DAOs. One design is shown below:

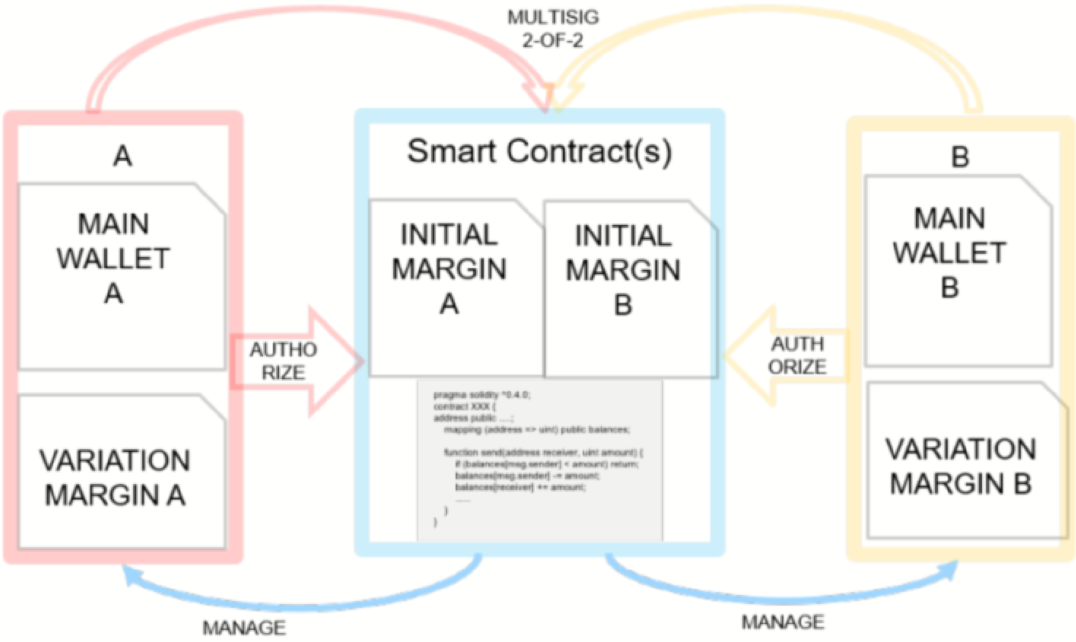



A variation on this design is to merge LPs into a large L based on DAOs.

The final outcome is an aggregated liquidity pool is created.

## 7.5 Collateralization

Collateralization models in DeFi and more generally in TradFi are well known [13]. For derivatives trade the risks involved are mitigated by requiring collateralized payments as the prices move. Below shows a diagram from Morini:




This can be shown by a simple example. Someone has an option to sell oil at 100 dollars (put option), and the market price was 100 dollars when the option was created but then fell to 80 dollars. The option writer would be facing a loss of 20%. That is a high loss, hence the option writer would be forced to make collateralization payments as the price fell, otherwise the option would default before the 80 dollar price was reached. The option writer could be required to pay collateral into the contract before the price fell and the option holder would have no loss except the premium (cost of the option).

### 7.6 Clearing and Settlements

Clearing Houses are well known in TradFi to reduce counterparty risk by maintaining account systems. They work on collateralized models.

Decentralized clearing networks work on similar principles to TradFi clearing houses, except the risk is maintained via DAOs [15]. This implementation would bolster use cases involving collateralized contracts.

## 7.0 Composability Use Cases

We focus on derivatives.

### 7.1 Liquidity Aggregation

This was partly explained before about how LPs can be merged or aggregated during a contract execution for a financial instrument.

This is one of the most important use cases.

## 7.2 Complex Products

Examples were given of linking up products (e.g. options and debt) and complex products are about nesting derivatives and making financial instruments include a lot of products.

## 7.3 Tokenization and Synthetic Assets

Tokenization models are well established, but composability opens the possibility for novel tokenization models. It is likely the standard SPV-NFT model will usually be used, but synthetic assets themselves are derivatives. This derivative could also be subject to composition. For example, a synthetic asset could be priced based on the values of different NFTs. This could introduce concepts similar to common stock and preferred stock and different voting rights. These again are all contractual conditions so the actual final asset could be adjusted accordingly.

## 7.4 Collateralization

As with other models, composability gives a lot of possibilities about collateralization. Collateralization itself is designed to lower risk but risk can also be tied and also passed to third parties via standard models such as CDOs and CMOs in TradFi.

In DeFi 2.0, we could for example link a collateralization requirement to a risk level and if the price moved too much, the contract could require a debt obligation to reduce risk (i.e. the lender takes risk of a default).

## 7.5 Innovative Products

Compatibility allows innovation at the EOA and CA level. These are not necessarily complex products but just innovative. A tenant for example could buy a future to buy his tenanted house which also required the landlord to clean the windows every week. If the landlord failed, then the contract would be voided and the obligation would not apply.

## 7.6 Decentralized Derivative Insurance

Compositions can facilitate the creation of decentralized insurance products that cover risks associated with derivative positions. By combining different protocols, users can secure protection against derivative-related vulnerabilities.

# 8.0 Technical Implementation

## 8.1 Smart Contract Infrastructure

### 8.1.1 Overview

It is a standard feature of solidity that one contract can execute another [16]. This contract execution path is the basis of the DeFi composition execution tree.

### 8.1.2 Role of Smart Contracts

The smart contracts will execute all the DeFi protocol functions. This includes derivatives, liquidity, DAOs.

## 8.2 Interoperability Protocols

### 8.2.1 Cross-Protocol Communication and Integration

### 8.2.2 Standardized Interfaces for Protocol Interactions

## 8.3 Decentalized Oracles

### 8.3.1 Real-Time Data Feeds for Compositions

### 8.3.2 Ensuring Data Accuracy and Security

## 8.4 Layer 2 Solutions

### 8.4.1 Scaling DeFi Compositions with Layer 2

### 8.4.2 Improving Transaction Speed and Cost Efficiency

## 8.5 Security Measures

#### 8.5.1 Auditing and Code Review for Protocol Safety

#### 8.5.2 Addressing Security Vulnerabilities in Compositions

### 8.6 Protocol Governance

#### 8.6.1 Decentralized Governance Mechanisms in Compositions

#### 8.6.2 Ensuring Consensus and Decision-Making

## 8.7 Composability Standards

One of the key standards is for options. We extend ERC20 standards as shown.

### 8.7.1 Options

```
interface IDeFiDerivative {
    // ... Existing functions

    function createOption(
        address _underlyingAsset,
        uint256 _strikePrice,
        uint256 _expirationTimestamp,
        bool _isCallOption
    ) external returns (address optionAddress);

    function tradeOption(
        address _optionAddress,
        address _counterparty,
        uint256 _premium
    ) external returns (bool success);

    function executeOption(address _optionAddress) external returns (bool success);
}
```

### 8.7.3 Liquidity Pools

```
interface ILiquidityPool {
    // Create a new liquidity pool
    function createPool(
        address[] memory _tokens,
        uint256[] memory _initialBalances,
        uint256 _feePercentage
    ) external returns (address poolAddress);
}
```

9. **Composability Middleware:**
   - Middleware Solutions for Easier Protocol Integration
   - Abstracting Complexity for Developers

10. **Front-End Interfaces:**
    - User-Friendly Interfaces for Composing Protocols
    - Enhancing User Experience and Accessibility

11. **Gas Efficiency and Optimization:**
    - Minimizing Gas Costs in Multi-Protocol Transactions
    - Strategies for Gas Optimization in Compositions

12. **Testing and Simulation:**
    - Simulating Interactions and Dependencies
    - Ensuring Robustness and Reliability in Compositions

13. **Developer Tooling:**
    - Tools and Frameworks for Building Compositions
    - Empowering Developers to Create Innovative Solutions

14. **Compositions Analytics:**
    - Tracking and Analyzing Protocol Interactions
    - Gaining Insights into Usage Patterns and Trends

15. **Use Cases and Examples:**
    - Demonstrating Successful Technical Implementations
    - Case Studies of Compositions in Real-World Scenarios

Remember to tailor these headings to the specific focus and details of your DeFi composition project.

# 9.0 Security and Auditing

# 10.0 Governance and Upgradability

# 11.0 Scalability and Performance

# 12.0 Regulatory Considerations

# 13.0 Economic Models and Incentives

## 13.1 Hedging and Speculation

# 14.0 Roadmap and Future Developments

# 15.0 Conclusion

# 16.0 References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# 7.0 Composability Use Cases

Abstract:

- A brief overview of the DeFi 2.0 project and its core objectives.

Introduction:

- Introduction to DeFi (Decentralized Finance) and its evolution.
- The need for innovation in DeFi and the concept of DeFi 2.0.
- Brief explanation of compositions and their significance in the DeFi ecosystem.

Challenges in Current DeFi Ecosystem:

- Exploration of the limitations and challenges faced by existing DeFi protocols.
- Liquidity fragmentation, composability limitations, scalability issues, etc.

Understanding Compositions:

- Definition and explanation of compositions in the context of DeFi.

- How compositions differ from traditional DeFi approaches.
- Benefits of composability for the DeFi ecosystem.

Building Blocks of Composability:

- Smart contracts and their role in enabling composability.
- Interoperability among different DeFi protocols and platforms.
- Standardization of interfaces and data formats for seamless integration.

Architecture of DeFi 2.0 Compositions:

- High-level overview of the proposed architecture for DeFi 2.0 compositions.
- Layered structure, including base protocols, composition layers, and user interfaces.

Composability Use Cases:

- Examples of how compositions can be applied to enhance various DeFi use cases.
- Cross-protocol lending, synthetic assets creation, yield farming strategies, and more.

Technical Implementation:

- Technical details of how compositions are implemented in the proposed DeFi 2.0 project.
- Integration of multiple protocols, data flow, and interaction between smart contracts.

Security and Auditing:

- Discussion of potential security risks associated with composability.
- Importance of code audits, formal verification, and security best practices.

Governance and Upgradability:

- Governance mechanisms for maintaining and upgrading the composition protocol.

- Balancing decentralization with the need for protocol upgrades and improvements.

Scalability and Performance:

- Strategies for addressing scalability challenges in the context of compositions.
- Layer 2 solutions, sharding, and other scalability-enhancing techniques.

Regulatory Considerations:

- Exploration of regulatory implications and challenges related to composability.
- Navigating compliance while promoting innovation in the DeFi space.

Economic Models and Incentives:

- Design of tokenomics and incentive structures to encourage participation and contribution.
- Rewards for liquidity providers, composability facilitators, and users.

Roadmap and Future Developments:

- Short-term and long-term goals for the DeFi 2.0 project.
- Planned enhancements, partnerships, and expansion of the composability ecosystem.

Conclusion:

- Summarize the key points discussed in the white paper.
- Reinforce the significance of composability in shaping the future of DeFi.

References:

- Citations and sources used throughout the white paper.

Remember that this list of headings serves as a starting point, and you can customize and expand upon each section to provide a comprehensive overview of your DeFi 2.0 project using compositions.

Regenerate

# 1.0 Title and Introduction

The focus of this research is to extend current knowledge in the field of DeFi compositions especially related to derivatives and RWAs. The final outcome will be to produce a new DeFi protocol for DeFi compositions, and to produce a new standard extending ERC20 and ERC721 standards for DeFi compositions. We consider this to be DeFi 2.0 [24].

DeFi itself has been emerging for a number of years but the direction has focused around DEXs and PLFs. We consider this to be DeFi 1.0. Little research was done with derivatives, despite the very large market in TradFi for derivatives (estimated to have a notional value of over 600 trillion dollars [11] just in the OTC market). By including derivatives into DeFi and enabling compositions we consider to be DeFi 2.0. The potential market is many times that of simple asset tokenization and could contribute to genuine new market wealth creation.

DeFi composition has been compared to Money Lego [15, 16] and has been seen as one of the main features of DeFi [14, 4]. Jensen at al. [13] confirmed the value of seamless integration when DeFi applications are on the same blockchain.

The current DeFi research has identified a lack of standards, high risks, and the need for new taxonomies for DeFi compositions. Also current research identified the need for a new DeFi composition protocol.

This proposal is for the following project offering:

| |
|---|
| **Blockchain Technology and Decentralised Finance (DeFi) : The Bridge to the Future of Finance**<br><br>*"Blockchain and Distributed Ledger Technology (DLT) provide building blocks of the so-called "Internet of Value", since they enable recording of interactions and transfer "value" referring to any record of ownership of* ***asset*** *- for example, money, securities, land titles – and ownership of specific information like identity, health information as well as other personal data. Blockchain enables communities, the decentralised Web, token economies, and global peer-to-peer payment."* |

*"You will conduct interdisciplinary research that **combines computer science and financial economics.**"*

Keywords: Financial engineering, Decentralized Finance, DeFi, Blockchain, Ethereum, DLT, Cryptocurrencies, Stablecoins, Cryptoassets, Derivatives, Synthetic Assets, DeFi Compositions, CBDC, DeFi Bridges, Asset Tokenization, Real-world Assets, Oracles, DeFi Composability, DeFi Interoperability, Liquidity Pools, Sidechains, DeFi 2.0

# 2.0 Background and Literature Review

## 2.1 Existing Literature

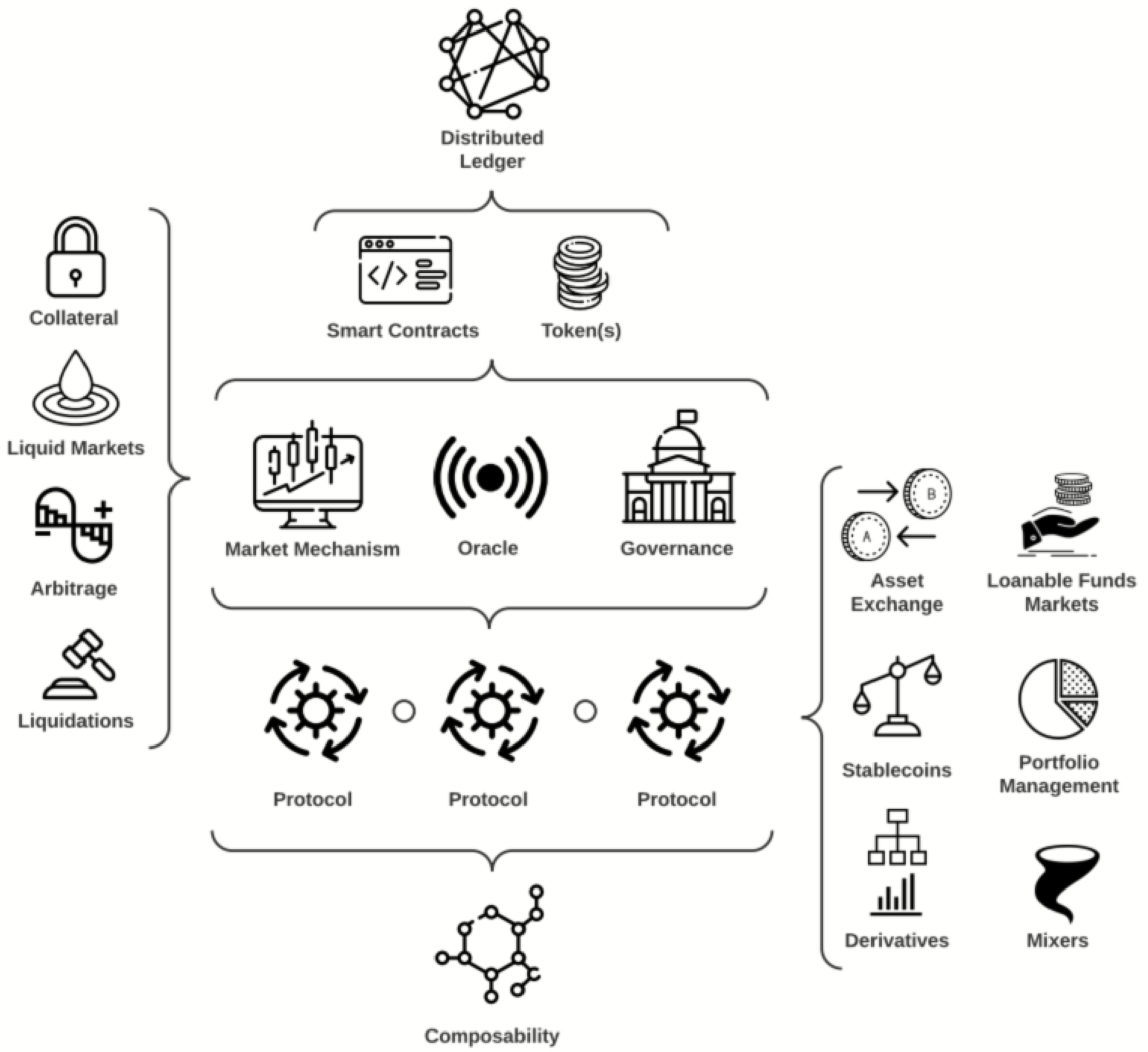
### 2.1.1 Systematization of Knowledge

Werner et al. [19] published results of a Systematization of Knowledge (SoK) for DeFi ecosystems along the following axes: its primitives, its operational protocol types and its security which synthesized computer science, economics and finance. It focused on technical and economic security.

They considered that DeFi has four properties: Non-custodial, permissionless, openly auditable, and composable. It is this composable aspect which interests us in this document. Composable is defined as financial services which can be arbitrarily composed into new financial products and services in a lego or building blocks fashion.

Werner et al. determined 99% of derivatives trading was centralized but emerging DeFi protocols were with synthetic assets, options, futures, and perpetual swaps.

The following diagram shows the DeFi conceptual overview [19]:




Risks in DeFi come from the lack of regulation and extreme transparency [21], as well as smart contract exploitation.

Carter et al. did extensive research on DeFi risk considering the following factors: (i) interconnections with the traditional financial system, (ii) operational risks stemming from underlying blockchains, (iii) smart contract-based vulnerabilities, (iv) other governance and regulatory risks, and (v) scalability challenges.

### 2.1.2 Disentangling Decentralized Finance (DeFi) Compositions

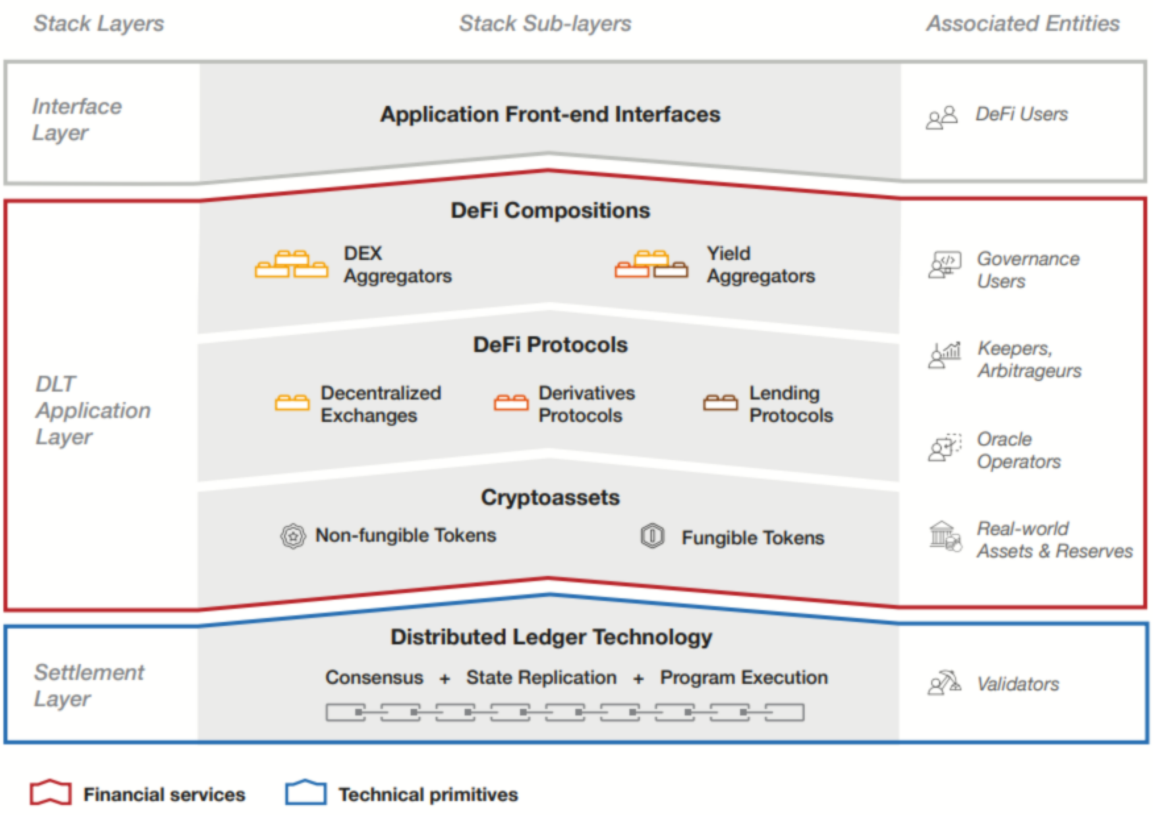
Kitzler et al. [4] studied 23 protocols and the interactions with over 10 million Ethereum accounts. Their work proposed disentangling protocols into protocol compositions. They also consider a building blocks or financial lego approach similar to other published research.

Kitzler et al. considered the following benefits were found from DeFi composition: ecosystem interoperability, web integration, and risks. They considered sidechains, rollups and off-chain networks.

Risks were considered by Kitzler et al. as analogous to the TradFi risks and the 2008 crash stemming from complexity and opaqueness.

### 2.1.3 The Technology of Decentralized Finance (DeFi)

Auer et al. [2] discussed how complex products could be assembled using composition and risk factors. Also they provided a general overview of the DeFi structure:




Auer et al. described the general architecture using synthetic tokens, oracles, DEXs, PLFs and derivatives.

## 2.2 Gaps in Current Research

### 2.2.1 Taxonomizing and Formalizing Models

Werner et al. determined a number of shortcomings in DeFi composability. Risks similar to rehypothecation risks in TradFi could exist but these are mostly unquantified. Tolmach et al. did propose a process-algebraic allowing property verification by modelling DeFi protocols in a compositional manner. But a critical gap in DeFi research was towards taxonomizing and formalizing models to quantify composability risk.

Auer et al. also confirmed there is a gap in taxonomy related to cryptoassets and derivatives, suggesting new standards are needed for mapping cryptoassets to derivatives.

An analysis of current DeFi taxonomy was given by Gogol et al. [20].

### 2.2.2 Risk Investigations

Kitzler et al. considered that understanding current compositions may assist in cross-chain composability. This could then help in deciding which services should be co-located and which would be separated.

Kitzler et al. also found that no studies had systematically investigated risk of DeFi compositions.

Auer et al confirmed that new financial models were needed to mitigate financial risk for existing protocols and adapting well-known methodologies from traditional finance to DeFi protocols. Research by Carter et al. [21] also confirmed challenges in DeFi were understudied in research about risk. That research was not about DeFi composition but DeFi generally.

### 2.2.3 Scaling Protocol (Aquo)

Kitzler et al. found that derivative protocols had relatively few compositions, suggesting a protocol-type specific scaling solution could be useful, e.g. a sidechain for derivative protocols.

### 2.2.4 Derivatives

Auer et al. confirmed that research into DeFi derivatives was far more limited than research into DEXs and PLFs.

## 2.3 Filling Current Gaps

### 2.3.1 Taxonomies

We will extend current taxonomies for DeFi compositions. The approach taken by Gogol et al. could be extended which splits taxonomies into Algorithms, Architecture and takes an approach of emphasizing risk to the token holder. For composition there are different risks and hence a different taxonomy could be needed.

### 2.3.2 Models

We propose to extend the models analysed by Werner et al. and their research which considered economic and technical security; models for a lego concept and new Lego models consisting of building blocks with a focus on atomicity.

Model is given a wide meaning in the research by Wener et al. and covers extensive concepts related to economics as well as in computer science. We propose firstly analysing that research in detail and then proposing more detailed approaches to solve the modelling problem. This would likely take the two-fold approach from Werner et al.: economic and technical.

Possibly we can use process-algebra as seen in Tolmach et al.'s research using Communicating Sequential Process (CSP).

### 2.3.3 Risk

One key risk to address is collateralization in any asset tokenization and derivative ecosystem. Morini [9] proposed a collateralization model which could be used for derivatives. For the composition itself, we propose to extend the work done by Kitzler et al. which considered risk via complexity to be a key risk. One possibility is extending the work by Atzei et al. [22] which examined vulnerabilities in smart contracts.

If a security vulnerability did exist in a building block then it could put other blocks at risk and even the entire composed transaction.

There are additional risks from a regulatory viewpoint but that is outside of the scope of this project.

It is likely that key risks in compositions will be due to vulnerabilities in other DeFi protocols and those risks end up being transmitted throughout the entire composed transaction. i.e. a lending platform failed to genuinely loan the money but the composed transactions did not detect that failure. One solution for that is to implement counterparty risk systems. These can implement decentralized clearing networks (DCNs) [9] but the DCNs themselves would also be subject to risk.

The risk work is likely to be extensive and involve a number of aspects.

### 2.3.3 A Scaling Protocol

We consider this to be a DeFi 2.0 protocol. This new protocol will focus on derivatives. A derivative in TradFi consists usually of an option, forward, future or swap. But in DeFi it is likely novel derivatives can be created.

Therefore, the protocol will need to work with a range of different types of financial instruments. It may be necessary to build demo platforms which actually have these financial innovations to test the DeFi compositions as it is likely not many derivative platforms exist.

Other combinations could involve combining lending with options and hence the protocol builds complex products. For example, someone decides to buy an asset for 100K USD but wants to borrow 80K and also has an option for another 100K in 12 months at a new price. Then the lending platform will loan the money, the asset sale platform completes the sale, and the derivatives platform sells the option. This is just one account transaction and the rest is a DeFi composition.

Kitzler et al. considered a sidechain might work and hence we should test sidechains.

Also in the protocol we can implement a combination of options, e.g. forward agreements (an investor has an option to buy a house in the future and also borrow against it in the future) [23].

## 2.3 State-of-the Art Developments

The main state-of-the art developments relate to DEXs and PLFs for DeFi protocols. DeFi itself has adopted ERC20 and ERC721 standards. The RWA methods are well known via NFTs for shares in SPVs. This is then tradeable via a synthetic asset.

These developments focus on Ethereum and solidity. The actual structure itself DeFi architectures is well established in state-of-the art design showing the layers shown in this document.

TradFi models and financial engineering is well established in TradFi but has yet to be mirrored in DeFi to any large extent.

# 3.0 Research Objectives

Our focus will be on RWAs and derivatives, and not PLFs or AMMs which are more researched.

## 3.0.1 Taxonomizing and Formalizing Models

We propose forming models to describe DeFi compositions and taxonomization for RWAs models with derivatives. This would extend established standards under ERC20 and ERC721 to provide standards for derivatives and crypto assets.

## 3.0.2 Risk Determinations

We propose extending current research to systematically assess risk in DeFi composition focusing on asset tokenization and derivatives. This should consider technical and economic risks extending the research done by Werner et al.

Also models from TradFi should be considered and applied to DeFi protocols with some adaptation.

## 3.0.3 Protocol Development

We propose developing a new protocol possibly based on a sidechain to provide the following for composed transactions:

- Risk Reduction (transparency)
- Increased Liquidity (LP aggregation)
- Ecosystem Interoperability (for one blockchain, but leading into cross-chain)
- Innovation (new financial products via financial engineering)

Cross-chain would be **out of scope** of this proposal but we could provide pointers on how cross-chain implementations might be done. Hence we would consider only Ethereum based DeFi protocols.

# 3.1 Intended Outcomes

## 3.2.1 Taxonomizing and Formalizing Models

A set of standards to rationalize DeFi compositions for RWAs and derivatives should be produced. This could be the basis of a new ERC standard.

### 3.1.2 Risk Determinations

A conclusion about the risks of using DeFi compositions for RWAs solutions also for new financial complex products (e.g. an option to buy an asset with a loan and with a swap) and proposed models to mitigate risk.

### 3.1.3 Protocol Development

We propose basing the protocol on Ethereum and using sidechain methods. It is likely that solidity and contract calls, e.g delegate calls, will be used. The final outcome should be a protocol allowing derivatives to scale under DeFi composition conditions.

# 4.0 Research Methodology

## 4.1 Literature Review

The initial work will focus on compiling literature summaries for DeFi compositions and related areas. Google Scholar has a lot of material for this. This should provide a summary of the current state of research.

## 4.2 Taxonomies and New Standards

This involves reviewing existing standards (e.g. ERC721) and considering how a DeFi composition standard could extend current standards. Also within this, taxonomies should be considered.

## 4.3 Protocol Development

This will involve examining current open source code, and producing new codebases. This will focus around solidity. It is likely this will require advanced coding as we will be using compositions.

We should be able to produce open source code aimed at implementation of a new standard.

Auer et al. [2] proposed two approaches: building blocks and protocol networks.

#### 4.3.1 Building Blocks

This approach involves assessing systemic risk from a building block and how a building block could be nested into a DeFi protocol.

#### 4.3.2 Protocol Networks

Another approach is to consider interdependencies between contracts in DeFi Protocols. The purpose here is to consider target and source contracts across two DeFi Protocols. Auer et al. considered this via a node structure which represented all the smart contracts for a DeFi protocol.

### 4.4 Quantitative Testing

Testing will likely involve creating data files for use cases and simulations of the protocols working. These are non-custodial solutions so any simulations will simulate the normal wallet approvals in a full implementation.

The testing should be able to confirm multiple DeFi protocols invoked from a single transaction, e.g. a LP gains access to tokenized assets in other protocols.

### 4.5 Financial Modelling

Our focus is on computer science, and not financial engineering, and hence modelling will be accordingly focused. The modelling aspect will be to analyse risk with a view to risk mitigation.

The financial world has extensive modelling for prices, risk models, and predictions. We only need to extract some key aspects for DeFi models. Under compositions we are more concerned with the actual protocols and individual DeFi protocols will assess pricing models more fully and actual trading patterns.

### 4.6 Tech Stack

The main elements are shown below:

Github, ReactJS, Javascript, Typescript, Bootstrap, Solidity, Hardhat, WalletConnect, CloudFlare, AWS, Azure, GCP (depends on cloud credits, Ubuntu.

It is likely a number of tools will be used for debugging and analysis of data packets to confirm interactions.

## 5.0 Research Scope and Limitations

### 5.1 Scope

The research should be limited to Ethereum and interactions on one blockchain. This provides solutions via contract calls.

Some indications about cross-chain solutions can be produced but these would only be a direction for other research.

The research is focused on RWAs and derivatives. There is already a lot of material about DEXs and PLFs, and we do not need to extensively research those topics. Also the derivatives market in TradFi drives much of the world economy.

## 5.2 Challenges

The main challenge will be lack of current research in derivatives, and the potential impact of derivatives. It was already widely reported in TradFi that derivatives were instrumental in the 2008 crash and that many traders and banks did not understand the actual financial products or the risks.

In DeFi it is likely the solutions will be very complex and hence any standards, risk mitigation and new protocols will need to solve the inherent problems in the TradFi sector which have been widely documented.

Another challenge is the size of the markets in derivatives is very high which would likely attract a lot of hackers and hence security in any new protocols would be a key factor. This would create additional challenges, for economic security and technical.

Composability of DeFi protocols can lead to complex interactions which are hard to analyse with far-reaching consequences [12]. This is another challenge.

DeFi compositions require independence between systems for stability and a possible risk is Systematic Dependencies between applications could result from tightly coupled DeFi applications [13]. This presents a challenge in designing new standards.

# 6.0 Contribution to Knowledge

## 6.1 Originality

Much of the current research was driven by DEXs and PLFs. Also much of the actual business side of cryptoassets has been just trading cryptoasset values similar to Forex trade.

The originality of this research will be to extend knowledge about how DeFi could work in compositions, and with derivatives. Derivatives in TradFi themselves grew rapidly since the 1980s and from the 1987 crash, there was a hiatus in growth until 1997. This evolution saw the development of a lot of concepts related to risk management, new product development, and growth.

Similarly it is likely that DeFi protocols will develop so that new risk models, products, and trading patterns emerge. Our research will contribute to this.

## 6.2 Applications and Implications

The possible applications and implications are wide ranging.

DeFi in TradFi terms is very small. TradFi processes many trillions of dollars a day, and underpins much of the trade in the world. DeFi is very nascent by comparison.

New research into DeFi protocols, standards, and risk, could greatly affect the adoption of new trading strategies with a corresponding economic growth.

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