Eidgenössische Technische Hochschule Zürich
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Chair of Entrepreneurship

Master Thesis

Novelty Assessment of Blockchain Startups in the Decentralized Finance Space

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Introduction

"Any sufficiently advanced technology is indistinguishable from magic."

— ***Arthur C. Clarke***

Blockchain technology, colloquially also known as 'crypto' is hailed as a groundbreaking technology that has the potential to revolutionize the financial services industry, especially the way people transact on a day to day basis. Some experts compare the invention of blockchain with the invention of the Internet. The long-term implications of this comparison would be tremendous, as we know that the Internet has not left any industry untouched.

Blockchain technology has the potential to give rise to innovative and unprecedented business models that fuel the emerging decentralized economy (Iansiti & Lakhani, 2017). In the context of the financial services industry, this would mean that all operations taking place today with the help of intermediaries such as banks can possibly take place without one. Clearly, incumbent intermediaries such as banks are facing an extraordinary amount of pressure to innovate and 'stay relevant'. One of the classical ways to do so would be to innovate or reinvent their business model. However, this is easier said than done. Pivoting an organization's entire business model is a bold step and for large enterprises and organizations 'running the business as it is' is the ideal state to be in. That being said, the competition to innovate in the financial services

industry is fierce. At the same time, the upcoming DeFi projects are fairly new in the landscape and find it difficult to challenge the already established institutions. One of the ways for DeFi projects to do so would be by incorporating new business models.

The current state of academic literature does not throw much light on business model innovation in the decentralized finance (DeFi) space on the Ethereum blockchain. It is also unclear how mature the DeFi projects are today—whether or not they are truly ready to challenge the traditional financial system head on. The purpose of this thesis is to find out whether the contemporary landscape of DeFi projects is truly innovative. If so, can we measure this innovation?

To answer the research question, we curated a list of active DeFi projects on the Ethereum blockchain and put it under scrutiny. We will illuminate how business model innovation of these projects can be quantified by leveraging frameworks from theory. Finally, we will discuss the key insights that can be drawn from this research.

In the next chapter, we review the contemporary literature on the following topics— blockchain, innovation/novelty, and business models.

Literature Review

> ***"I believe you have to be willing to be misunderstood if you're going to innovate."***
>
> ***— Jeff Bezos***

Blockchain

Blockchain technology is still in its infancy. At the core of blockchain lies decentralized ledger technology (Du et al., 2019; Gomber et al., 2018; Swan, 2015). Gomber et al., (2018) described blockchain as "the central technical innovation associated with blockchain is digital ledger technology, which is defined as the use of decentralized trust verification through encrypted digital signatures."

According to Christidis & Devetsikiotis (2016), the key advantages blockchain brings to the table are:

- Ownership of data is possible without having the need to rely on a third party
- Transactions on-chain are open and transparent, and in some cases even permissionless.
- Blockchains are inherently fault tolerant in nature. According to Wikipedia, "Fault tolerance is the property that enables a system to

continue operating properly in the event of the failure of one or more faults within some of its components."

Du et al. (2019) put forward five IT elements of blockchain:

1. Distributed ledger: Multiple replicas of the ledger are stored by multiple nodes. Each node will have identical knowledge (set of transactions).
2. Consensus mechanism: Algorithm that helps the nodes achieve consensus when a new block is added to the blockchain.
3. Encryption mechanism: Algorithm that encrypts the metadata stored on-chain.
4. Smart contracts: Self executing programs that entail the business logic of the decentralized application.
5. Immutable audit trail: Chronological addition of blocks to the blockchain allows for anyone to audit the trail.

The business applications or use cases of the blockchain technology expand to various horizons. In the supply chain industry, blockchain technology can be employed to advance the current "track & trace" technologies. For instance, an increasing number of consumers are more conscious about the provenance of the food they consume. Blockchain technology can promise them authentic data traceability. In the financial services industry, blockchain technology can play an instrumental role in optimizing per transaction cost as

well significantly reduce probability of fraud (Chen & Bellavitis, 2020). The centrepiece of this thesis revolves around the financial services evolution on blockchain.

Innovation

Kline & Rosenberg (2009) identify innovation as complex, uncertain, disorderly, and subject to change. Innovation is difficult, and measuring innovation could be even more difficult. Fagerberg (2006) professes that the human nature of the brain has a knack to consistently improve the way we do things. This plausibly means that innovation is as old as the human race.

In academic literature around innovation, it is crucial to know the difference between innovation and invention. As per Roberts (2015), Innovation = Invention + Exploitation. Roberts (2015) emphasizes that, "The invention process covers all efforts aimed at creating new ideas and getting them to work. The exploitation process includes all stages of commercial development, application and transfer, including the focusing of ideas or inventions toward specific objectives, evaluating those objectives, downstream transfer of research and/or development results, and the eventual broad-based utilization, dissemination and diffusion of the technology based outcomes." According to Rogers (1995), there is a lag of many years between invention and innovation. Apropos to this, Gawer (2014) raises a question in her paper whether innovation should generate economic impact instantly or eventually.

To measure innovation, Smith (2005) points out that the main idea is to spot emergence of new indicators of innovation. Innovation happens incrementally over a period of time. Smith (2005) highlights that these incremental changes over a longer run will make a remarkable technological and economical impact. Collaboration and interactive learning build the foundations of innovation. According to Cusumano & Gawer (2002), companies do not live in a vacuum. They live in a vibrant ecosystem where there is a constant exchange of knowledge and experience. In such an ecosystem, innovation is the most important source of competitive advantage (Suroso & Azis, 2015).

Utterback (2017) points out that firms may innovate aggressively where they see a low hanging fruit on the tree, i.e. quick short run profit. Firms innovate in four broad phases; idea generation, problem solving, implementation, and diffusion. The rate at which organizations innovate is also a crucial indicator of whether the product is expanding (Utterback, 2017).

Business Models

Business models are the heart and soul of any business— big or small (Teece, 2010). Since scholarly literature on business models view this topic with a variety of different lenses, different schools of business models have come up. Each of the definitions are set out to answer different research questions.

Osterwalder et al. (2005) defined business models as "a conceptual tool that contains a set of elements and their relationships and allows expressing business logic of a specified firm… a description of the value company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital, to generate profitable and sustainable revenue streams". Wirtz et al. (2016) approach business models as "a simplified and aggregated representation of the relevant activities of a company".

Zott et al. (2011) believes that the invention of the Internet played a significant role in propelling the rise of business models as a research concept. The literature around business models largely revolves around e-businesses and how information technology is leveraged in organizations. Zott et al. (2011) also talks about how literature on business models also revolves around organization's strategic management with a focus on gaining competitive advantage, value creation, and firm performance.

A good portion of literature on business models works with technology management and innovation (Zott et al., 2011). Zott & Amit (2010) view business model as "a system of interdependent activities that transcends the focal firm and spans its boundaries." According to Chesbrough (2010), "[...] business model innovation is not a matter of superior foresight *ex ante* — rather, it requires significant trial and error, and quite a bit of adaptation *ex post*". Business model

innovation is not just about using 'better' technology. It is about experimenting with the alternative business model to explore various outcomes that maximize revenue, customer satisfaction, and other important key performance indicators (KPIs). Organizations can enhance the locus of their innovation by employing Zott & Amit (2010) design elements and design themes. Amit & Zott (2012) find that organizations can innovate their business model by coming up with new activities, their governance, and/or the way they are linked. Amit & Zott (2012) also claim that business model choices seldom go unchallenged within organizations. This was reclaimed by Snihur & Zott (2020); they called this lasting nature of the business model 'imprint stability'.

In the coming chapters, we will find out how to use Zott & Amit (2010) framework to identify innovative organizations.

Bringing It Together: DeFi + Innovation + Business Models

"Everything has beauty, but not everyone sees it."

— ***Confucius***

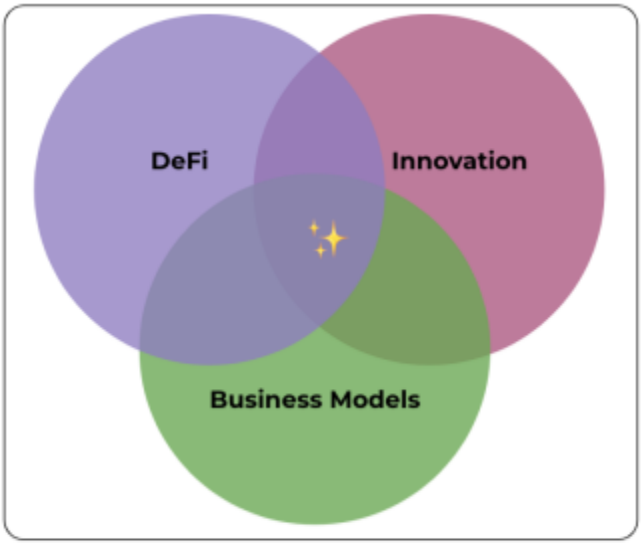

Figure 1. Intersection of DeFi, Innovation, and Business Models

This thesis primarily aims to unravel the phenomenon that is happening at the junction of DeFi, innovation, and business models, as seen in Fig. 1. Among crypto-native audiences, DeFi is heralded as a financial revolution. In the traditional centralized financial system, all financial transactions are settled with the help of a financial intermediary. The purpose of these intermediary parties is to reduce per transaction cost and to mediate transactions efficiently, securely, and smoothly (Benston & Smith, 1976). As the aggregate world economy

expanded in size and geography, these financial institutions became increasingly powerful. One might say that they become too powerful. The competitiveness in the financial industry is cut-throat; the financial organizations protect their intellectual property through various means such as copyrights, patents, trade secrets very dearly. As a consequence, the incumbent financial services operate in silos making it extraordinarily cumbersome to move capital across different services. These factors combined fuel development of business model innovation i.e. DeFi (Markides, 2006; Teece, 2018).

DeFi allows users to break free from the shackles of centralized finance in five abstract ways (Chen & Bellavitis, 2020):

1. Decentralization: Decentralized peer-to-peer (P2P) networks working in coherence with each other would eliminate the need for an intermediary. This potentially creates a network effect, the more number of peers in a network the more secure the blockchain would be (Catalini & Gans, 2019).
2. Innovativeness: DeFi is all about combinatorial innovation (Chen & Bellavitis, 2020). Developers can openly and permission lessly build financial applications (Cerf, 2012; Chesbrough & Alstyne, 2015). Some of these applications may act as composable building blocks for other applications, hence combinatorial innovation (Brynjolfsson & McAfee, 2014).

3. Interoperability: The concept of transacting over multiple blockchains is still in the works in DeFi. Some “bridges” have been built to enable interoperability across chains. However, full interoperability has not been achieved yet. Conceptually, this will enable assets to be mobile between different services seamlessly, potentially giving rise to an “Internet of value”.
4. Borderlessness: Centralized finance has a very limited scope, it is far from being borderless. It is tied down with geographical and fiscal & monetary regulations. Currently with very limited legal regulations around DeFi, these applications are borderless in nature.
5. Transparency: With most blockchains being public and permissionless, ledgers organically allow for users to audit every transaction on-chain. With applications running on blockchain, users can audit not just transactions but also the open-source smart contracts (software program) that they would be interfacing with while using an application.

These five ways resonate with Zott & Amit (2010) design themes which are the source of value creation in a business model. The four design themes are and here is how they relate to DeFi:

1. Novelty: DeFi is enabling new ways in which finance can be realized. For example, the governance of chains is completely

decentralized as opposed to being completely centralized. The execution of law is done via smart contracts instead of a handful of people. DeFi is empowering people to begin transacting at their own terms leading to a more equitable and fair financially inclusive society.

2. Lock-in: DeFi has a very low "lock-in" quotient, instead it is open, transparent, borderless, and permissionless.
3. Complementaries: With combinatorial innovation, new products are emerging which is arguably opening new ways in which users can transact.
4. Efficiency: DeFi is playing a key role in reducing the per transaction cost, increasing interoperability across chains.

From Zott & Amit (2010) activity system perspective, DeFi is creating new design elements or architecture of activity system:

1. Content: Focuses on the variety of activities of services the organization performs. New types of currencies such as programmable cryptocurrencies are coming up.
2. Structure: Describes the fashion in which the content or activities are glued together. For example, P2P networks work very well thanks to the underlying consensus algorithm that links all the peers together. Decentralized applications are linked to one another through composable smart contracts.

3. Governance: Refers to who is in charge of performing the activities. A large part of DeFi is now shifting towards open governance or towards decentralized autonomous organization (DAO) to define the future of their projects.

According to Snihur & Zott (2020), "Firms such as new ventures can innovate their business model by adding activities (novel content), bringing in partners to perform specific activities (novel governance), or linking activities in novel ways (novel structure)."

Research Design

> ***"Creativity involves breaking out of established patterns in order to look at things in a different way."***
>
> ***— Edward de Bono***

The purpose of this section is to outline the research strategy employed for the thesis. Drawing parallels between literature and thesis's research context is not elementary. Hence, devising an appropriate and effective methodology becomes key to justify the research question.

In context to this thesis, there are two facets of research design to choose from; quantitative or qualitative and inductive or deductive. Selection between inductive or deductive research approaches keeps the relationship between theory and data at the core. Refer to Fig. 2 and Fig. 3 to know more about inductive and deductive approaches to research. The research approach selected here by the charts out the rest of the roadmap of the thesis. On the other hand, the choice between qualitative or quantitative research style is a tactical choice and would primarily impact the data analysis segment of the thesis.

The goal of inductive reasoning or exploratory research is to generate knowledge. "It is improbable that the conclusion is false if the premises are true"

(Hurley, 2014). The goal of deductive reasoning or conclusive research is to demonstrate that if premises are true, it is impossible for the conclusion to be false.

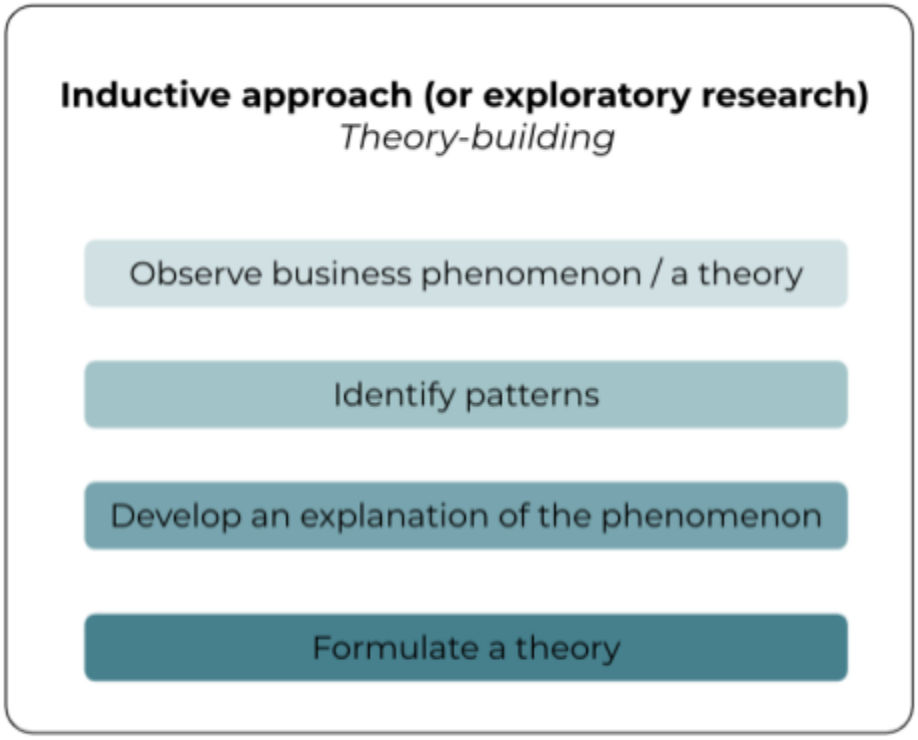

Figure 2. Inductive approach

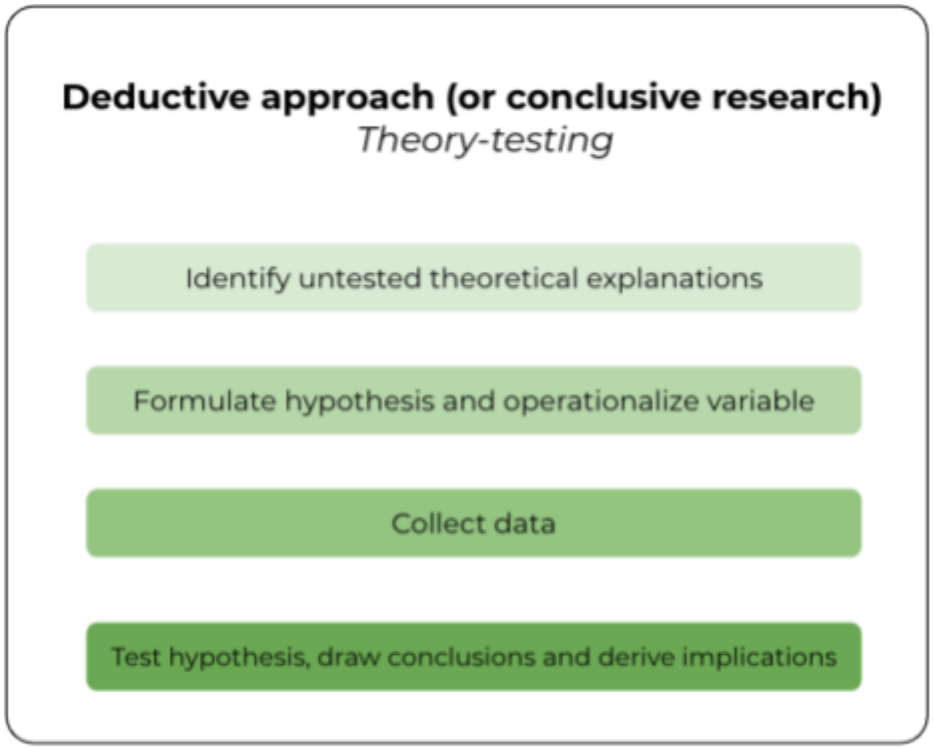

Figure 3. Deductive approach

At the core, the inductive approach is theory-building and the deductive approach is theory-testing.

The way data is analysed largely depends on the method used to collect data, i.e. whether the data is qualitative or quantitative in nature. The qualitative approach comes in handy when the goal is to surface abstract interpretations. Qualitative approach is especially useful when the research phenomenon is difficult to measure. The quantitative approach would be a prudent choice when the research phenomenon is lucidly observable and measurable.

This thesis employs an deductive or conclusive research approach coupled with data analysis using a quantitative method. The following subsection gives supporting arguments as to why we made the aforementioned decisions.

Research Strategy

This section briefly outlines the research strategy. Formulating an effective research strategy for a thesis is a critical task. The research strategy has to not only sufficiently answer the research question but also be efficient enough that keeps in mind the limited duration of the research. As mentioned in the previous subsection, this thesis follows an deductive approach integrated with a quantitative research method.

The research starts with *identifying untested theoretical explanations*, i.e. exploring and measuring innovation taking place in blockchain. The crypto space is currently buzzing with various technology trends such as decentralized finance (DeFi), decentralized autonomous governance (DAO), non-fungible token (NFT) mania. The focus of this thesis is on the DeFi space.

The DeFi crypto space has many ongoing projects. Naturally, not all of them can be studied efficiently during the limited time of research. Therefore, we created a filtering mechanism which gave us a set of projects; on which the analysis would eventually be conducted.

Once the filtered population is obtained, it is necessary to do a sanity-check, i.e. it is important that the narrowed down, filtered population is proportionately smaller than the universal population. In other words, it is important to ensure that the refined repository of the projects undergoes stratified sampling, as illustrated in Fig. 4. According to *Stratified Sampling - Wikipedia*, "In statistics, stratified sampling is a method of sampling from a population which can be partitioned into subpopulations."

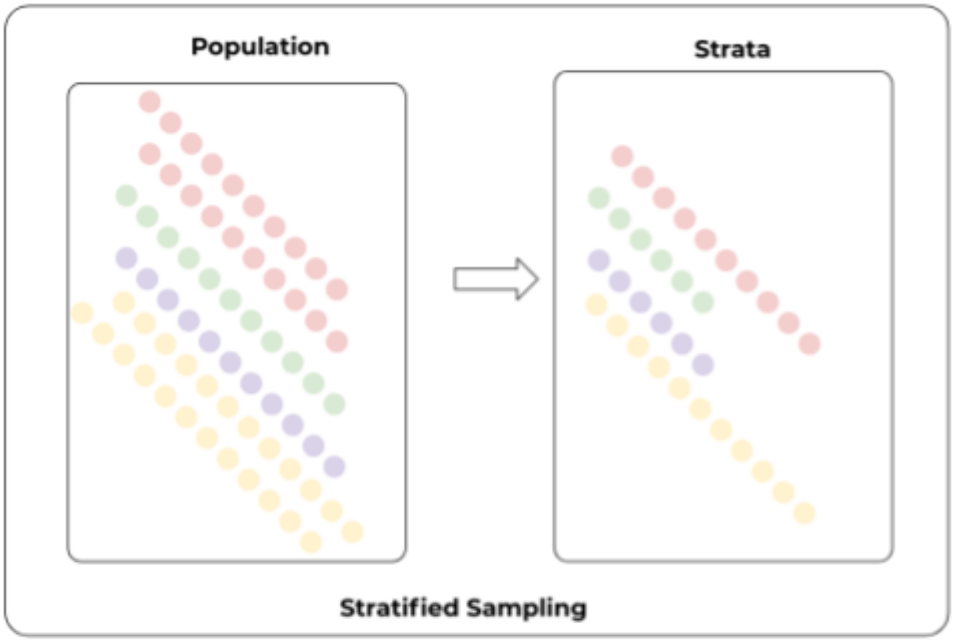

Figure 4. Stratified sampling

Now that the master data repository is in place, we *collected data* on each of the projects that is in sync with the *theoretical framework proposed by Zott & Amit (2010)*. We collected information on three design fronts— content, structure, and governance. To gauge business model innovation in each of these projects, these projects were then scaled based on a rubric or a generated coding scheme with respect to baseline archetypes of their respective categories. This exercise

helps identify local design patterns between the projects, which essentially sets the stage to develop relationships between various design patterns that merge. Finally, we *tested the theory and drew insights* that link our findings to the relevant literature.

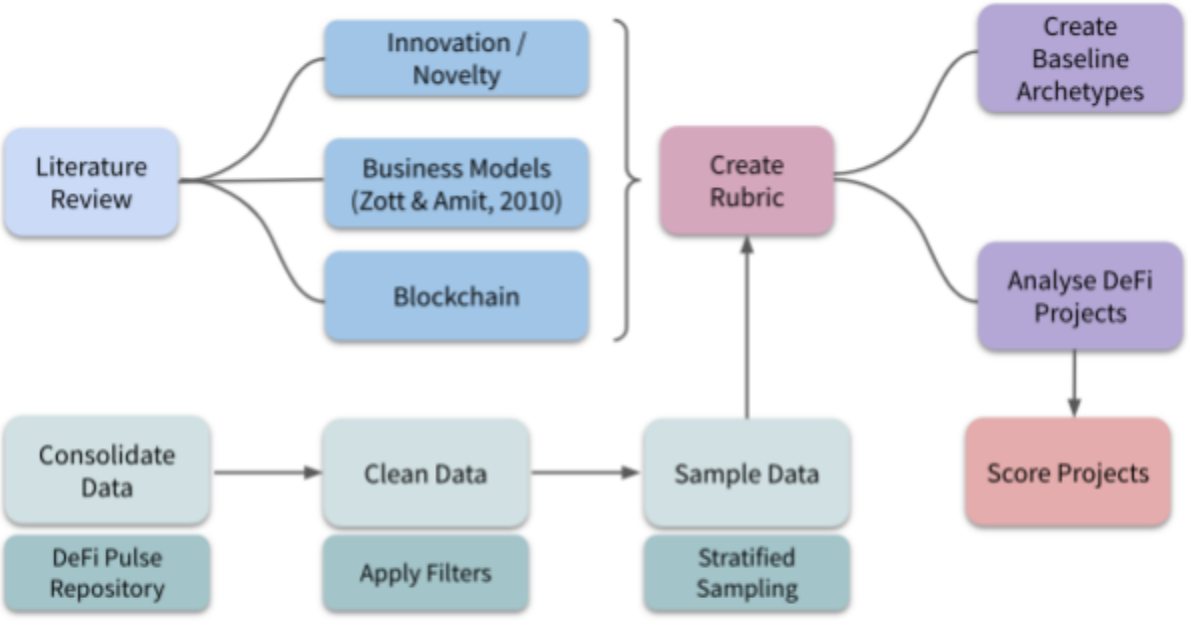

Figure 5. Research roadmap

This is the outline of the research roadmap (Fig.5) that was followed during the course of this thesis. The next chapter will elaborate more on the data collection strategy.

Data Collection

> "**Data is a precious thing and will last longer than the systems themselves.**"
>
> **— Tim Berners-Lee**

This chapter describes in detail the plan of action that was used to collect empirical data vis-à-vis DeFi projects.

DeFi Project Collection

The scope of this thesis is defined by the bracket of projects that would be put under the lens. There are many functional and theoretical blockchains in the ecosystem. However, this thesis focuses on the ecosystem synthesized on the Ethereum blockchain. There are many different verticals or classes of use-case applications built on Ethereum such as DAOs, NFTs, insurance, education, supply-chain, etc. The primary focus of this thesis is to cater to innovation specifically in the decentralized finance space.

The first step in this process was to identify a universal set of DeFi projects. There are hundreds of DeFi projects based on Ethereum, however it is rendered impractical to analyse each one. Therefore, we began with finding a list of all DeFi projects that are currently on Ethereum. This list was pre-curated by

DeFi Pulse Index. The name of the list is "The DeFi List"[1]. At the time of research, this list comprised 178 projects. For the sake of organization, this list was divided into eight buckets— lending, trading, payments, wallets, interfaces, infrastructure, assets, and scaling. Refer to Fig. 6 and Table 1 for more details on the total pool.

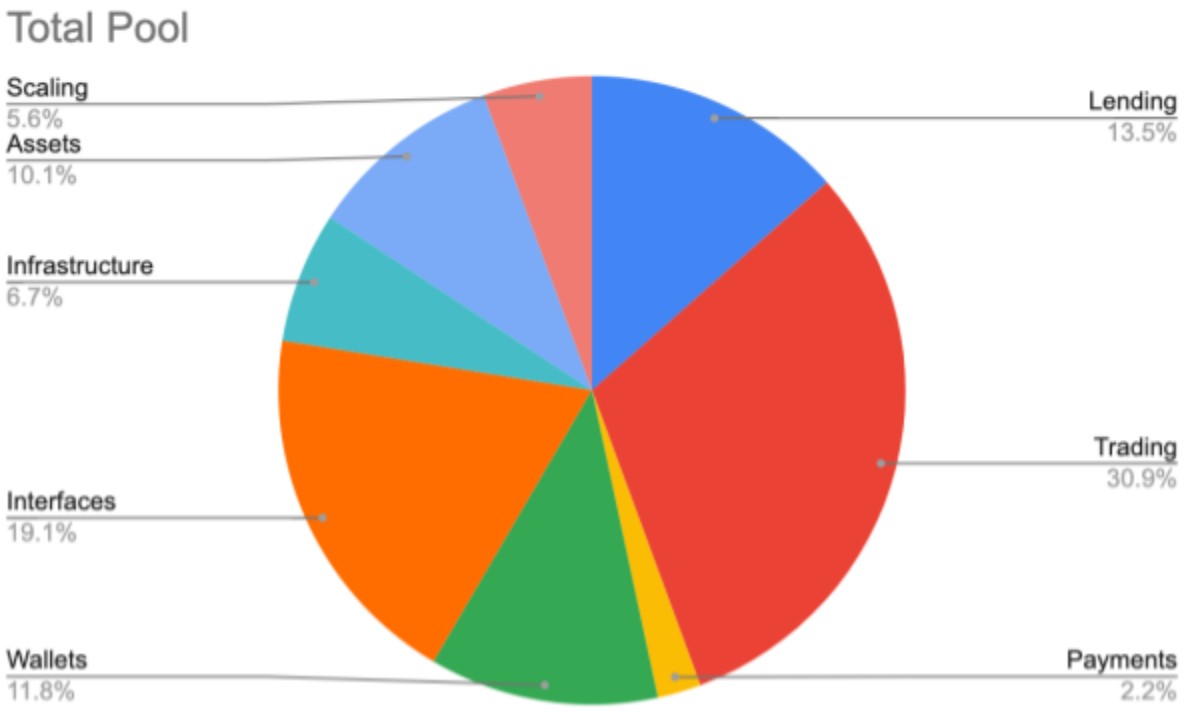

Figure 6. Total pool of DeFi projects

[1] The repository can be found here: https://defipulse.com/defi-list/

Table 1. Total pool summary

Category	Total Pool
Lending	24
Trading	55
Payments	4
Wallets	21
Interfaces	34
Infrastructure	12
Assets	18
Scaling	10
	178

To understand the DeFi list better, it will be good to know what each category entails.

- Lending: Categorizes all lending and borrowing protocols in one place such as Aave, Compound, etc. Users can easily borrow and lend crypto assets from and to other users respectively.
- Trading: Brings together all decentralized exchanges (DEXs) together such as Uniswap, Sushiswap, etc. Users can trade their crypto assets without the need to use services of a centralized third-party such as a stock exchange.
- Payments: Lists all payment solutions. Users can make miscellaneous payments. For example, one of the protocols Sablier can be used to pay with crypto assets in real-time. Payments can be released on a monthly, weekly, hourly, per minute rate, or even per second rate.

- Wallets: Catalogues all wallet solutions together. Users can use crypto wallets to securely store their crypto assets without relying on a third party. Some common industry standards include MetaMask.
- Interfaces: Users can manage their crypto-assets that could possibly be scattered across multiple protocols, or even on different blockchains using one-stop solutions such as Zapper.
- Infrastructure: Infrastructure caters to miscellaneous services that are required for adequate functioning of the ecosystem. Some of the solutions include Graph Protocol which is an indexing protocol used to query data on the blockchain using GraphQL.
- Assets: Cryptocurrencies claim that they could perform better than traditional payment systems. Solutions under the category 'Assets' comprise different kinds of cryptocurrencies with a variety of monetary policies.
- Scaling: At the moment, the Ethereum blockchain is not scalable or fast enough to match the services offered by traditional players. In order to bring about more adoption and usability, blockchains need to be more stable and fast. This category 'Scaling' comprises projects that aim to enhance the throughput of transactions on-chain.

The second step we refined the list to arrive at a subset of projects that could be analysed. Several filters need to be applied to clean the list. The idea was to retain the projects that are still alive and are continuously working in the

ecosystem. Here is a list of filters that were applied to 178 projects, upon application of these filters we were left with 80 projects:

- Had a functioning website
- Had a GitHub profile
- Latest activity on GitHub should not older than 18 months
- Had a documentation or white paper
- Had more than 5,000 followers on Twitter
- Latest Tweet engagement with community on Twitter should not be older than 12 months
- Had more than 3,000 participants on their community forum such as governance forum, Discord, Telegram.
- Had English as one of the languages on their website and documentation/whitepaper

It is important to have the resulting 80 companies be in equal proportion to the original, universal set. This can be confirmed from Fig. 7 and Fig. 8. Maximum error tolerance set is +/- 1.5%.

Before

Category	Total Pool
Lending	24
Trading	55
Payments	4
Wallets	21
Interfaces	34
Infrastructure	12
Assets	18
Scaling	10
	178

Stratified Sampling

After

Category	Filtered Pool
Lending	10
Trading	24
Payments	2
Wallets	9
Interfaces	16
Infrastructure	6
Assets	8
Scaling	5
	80

Figure 7. Before and after stratified sampling of DeFi projects

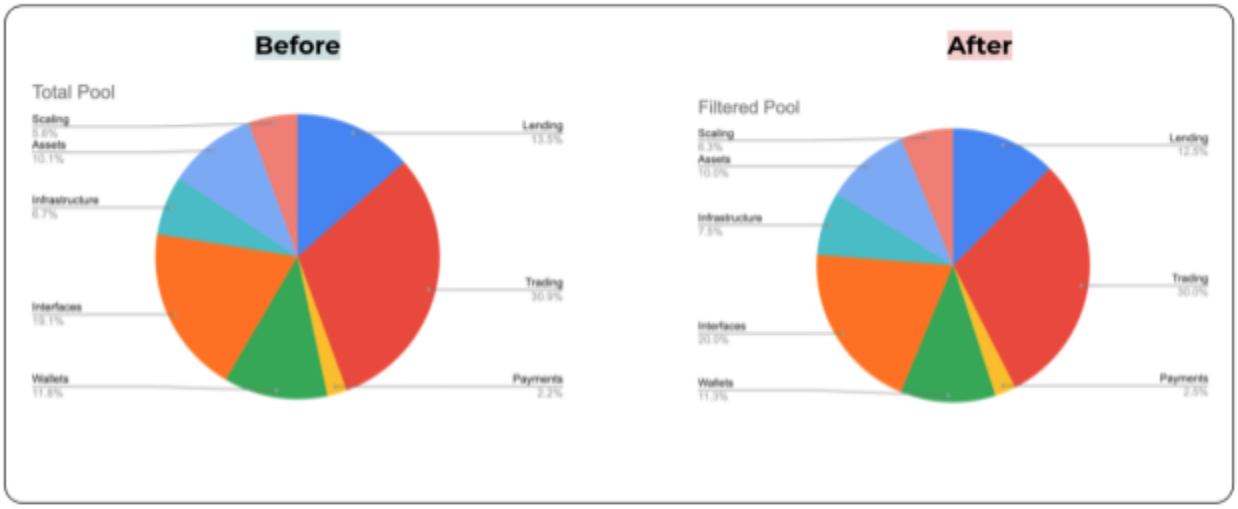

Figure 8. Pictorial representation of before and after stratified sampling of DeFi projects, keeping +/- 1.5% tolerance

Now that the list of projects is in place, the next steps call for creation of baseline archetypes for each of the categories. The resultant baseline archetypes will be used to gauge innovation in the DeFi projects. We will learn about how we measure innovation in the next chapter.

Rubric Design and Analysis of DeFi Projects

"Curiosity begins as an act of tearing to pieces of analysis."

— Samuel Alexander

The aim of this chapter is to elaborate on the rubric design or the coding scheme followed to rate the DeFi projects to judge whether the business model innovation is low or high. The structure of the project's business model is directly compared with the business model structure of the baseline archetypes.

Table 2. Coding scheme

Project	Content	Governance	Structure	Value proposition offered to the end user	Governance Model	Linkage of activities

Table 2 represents the rubric or coding scheme that would be followed through the thesis. Each project's data is collected against three fronts: content, structure, and governance. These three fronts are then compared with the corresponding baseline archetypes and a final score is awarded. There are three criteria based on which rating is done. Content is related to the 'value proposition offered to the end user', governance is related to 'governance model',

and structure is related to ‘linkage of activities’. This score is an integer between 1 and 4. The detailed rating scheme is:

- 1 is awarded when the design element of the business model is greatly similar to the baseline archetype.
- 2 is awarded when the design element of the business model is mostly similar to the baseline archetype.
- 3 is awarded when the design element of the business model is quite different to the baseline archetype.
- 4 is awarded when the design element of the business model is very dissimilar to the baseline archetype.

Going from 1 to 4 shows there is increasing innovation in that direction.

The third step is to begin populating the first four columns of the rubric by analysing each project one by one. This is done by scanning each project’s website and going through their documentation and/or whitepaper. See the appendix to view the rating of each of the projects.

The fourth step is to create baseline archetypes against which all the projects will be assessed to find out whether business model innovation is high or low. These archetypes are solely based on Zott & Amit (2010) business model design elements and design themes. Each category has a corresponding baseline archetype to it. There are two exceptions to be noted, payments and scaling have the same archetype because the underlying context is very similar and infrastructure as a category is ruled out of scope because the category was too arbitrary and miscellaneous for a baseline template archetype to be fashioned.

ARCHETYPE 1: Lending (Commercial Banks)

- Activity System Content:
    1. Banks are managing considerable amounts of lending, i.e. give out loans to individuals, businesses, and other entities.
    2. Banks also provide an interface to manage flow of money between different entities.
    3. Nowadays banks also offer a variety of ways in which one can bank. For example, e-banking and mobile payment systems (e.g., Twint).
    4. Most full-service banks today offer a suite of individual and business financial and management services (see complementaries) but on the lending part the following services apply:
        - Individual
            - Checking account management & debit cards
            - Credit cards and short-term lending

        - Mortgages
        - Other lending such as consumption
    - Business
        - Credit lines etc.

- Activity System Structure: A bank's large portion of revenue comes from the interest payments from the borrowers. A portion of this interest may be redirected to the depositor's account. The money that banks lend is essentially the money depositors deposit in their accounts. In addition, it is not uncommon for banks to mint money from thin air. A typical bank may follow the following structure: Usually hierarchical internal organization with different experts for different domains (lending, brokerage, etc.)
    a. Branches for direct f2f customer contact
    b. Online services for fast consumer credits
- Activity System Governance: The banking industry is a highly regulated industry. Commercial banks are also responsible for executing monetary policy set by the central bank. Usually, full-service banks are fully integrated; owning all their customer relationships and determining credit ratings etc.
- Lock-in: Switching costs in banking can be high. These costs can be in the form of transactional costs that are to be incurred by the party wanting to change the bank, the time invested to take care of the paper work and look for other better alternatives.

- Complementaries: Most banks these days offer many more services beyond lending and managing cash flow. For example, wealth management, insurance, and brokerage
- Efficiency: Interacting with the platform is seemingly efficient, however the wrinkles surface usually when a customer wishes to carry out transactions with large sums of money, or make international transactions. This is probably a spillover of the policies that the central bank and government make.

ARCHETYPE 2: Trading (Stock Exchange & Brokerage Services such as PostFinance)

- Activity System Content:

  a. Core function of a stock exchange is to facilitate fair trade of securities.

  b. It also has to ensure enough liquidity of stocks for the stockbrokers and traders, usually achieved by market makers.

  c. Before listing a company on the exchange, a stock exchange has to carry out a thorough due diligence of the company to ensure safety of trades.

  d. A typical stock exchange will have a very robust IT infrastructure backing it. This IT infrastructure may be very complex, the most important part would be to have an electronic bidding system which the traders leverage.

  e. Traders can leverage Level II data to get insights into a stock's price action.

- Activity System Structure: A stock exchange's major stream of revenue comes from transaction fee revenue, listing fee revenue, data fee revenue, trading software and technology revenue, registration and regulatory fee revenue, governance services revenue.
- Activity System Governance: Very strict rules and regulations have to be adhered to. Entities such as the U.S. Securities and Exchange Commission (SEC), Financial Industry Regulatory Authority (FINRA), National Association of Securities Dealers (NASD) govern how the stock exchanges should function. Some exchanges may also have to abide by some treaties. Also, an internal team of governance would also be in place to carry out compliance.
- Lock-in: A lengthy procedure has to be followed to move securities from one exchange to another despite the fact that all exchanges over the world are connected.
- Complementaries: Usually exchanges offer many complimentary services beyond a marketplace for transactions such as providing real time data of trades flowing through the exchange, specialised software to monitor the trades in an efficient way, offer services like market makers, governance, risk, and compliance services.
- Efficiency: For the end buyer and seller, it is fairly expensive to interact with the exchange since they need a broker in the middle. Average time taken for a trade to settle is usually two business days.

ARCHETYPE 3: Payments and Scaling (Visa and MasterCard)

- Activity System Content:

  a. The primary role of a payment network is to facilitate transactions between involved parties.

  b. These payment networks leverage Point of Sale (POS) infrastructure to process and record transactions.

  c. They promote cashless payments.

  d. These payment networks provide a full range of domestic as well as international transactions processing services, from credit and debit cards to funds transfer, mobile payments and services, online transactions, commercial payments, and secure delivery of government benefits.

  e. These payment networks have sophisticated algorithms in place to detect fraudulent transactions. Nowadays, many of these networks are leveraging the power of big data and machine learning.

- Activity System Structure: Merchants pay the payment network a small transaction fee for each customer transaction as part of the cost for the network processing services that the company provides.

- Activity System Governance: The payment network must comply with the law of the land where it is based, including trade sanctions administered and enforced by the Office of Foreign Assets Control (OFAC) if it is the U.S.. OFAC prohibits or restricts transactions with certain countries, organizations, and individuals.

- Lock-in: Very highly positive network externality. Lock-in is high. Difficult to switch from one payment network to another. They are mostly siloed.
- Complementaries: Usually different payment networks have different bonus programmes and insurances linked to them.
- Efficiency: They are fairly fast in clearing the transactions but settlement takes longer. Interaction with them is fairly expensive, especially from the merchant's point of view.

ARCHETYPE 4: Wallets (Checking accounts and physical wallets)

- Activity System Content: Checking account is a very common way to keep money available to use while it is protected by the custody of a bank. Another way to store liquid currency is to simply keep the bank notes in a wallet.
- Activity System Structure: Banks usually charge an annual maintenance fee from the customer to keep the service available. The relationship between depositor and the bank stands on the foundation of trust.
- Activity System Governance: While the bank has to follow the law of the land, the checking account of a customer comes under direct purview of the bank. The bank can withdraw money from a checking account anytime they feel fit.

- Lock-in: High lock-in, switching checking accounts is difficult and time consuming.
- Complementaries: Passbook service is offered to customers where they can monitor activity of their account.
- Efficiency: It is simple and usually inexpensive to interact with the checking account. However, in some economies, with negative interest rates, customers lose money when they put it in a checking account.

ARCHETYPE 5: Interfaces (Wealth Management Apps such as UBS Wealth Management)

- Activity System Content:
    a. Usually these apps are backed by a bank as a complementary service.
    b. They provide the user with advice on investment ideas from experts. In some cases, experts may step in to do a risk assessment of the portfolio.
    c. These apps put together an investment portfolio for the customer.
- Activity System Structure: Different banks may have different revenue models for their wealth management apps. Some may charge on a subscription basis, others may charge on a per transaction basis, or it may be included in their banking package.
- Activity System Governance: Even though at the end of the day, the client himself is responsible for the investment decisions he makes, there is a

whole team of experts whose ultimate aim is to increase profits on their client's portfolios. In such cases, internal monitoring and governance is given a very high priority. Other authorities which are applicable to stock exchanges also apply here since wealth management apps are nothing but interfaces to the markets.

- Lock-in: High lock in. For example, if a customer is using UBS's wealth management app, it would be difficult for them to transfer all his wealth to another bank's ecosystem.
- Complementaries: Depending upon the principal value the client is investing, they may be given more tailored advice or even a personal account manager to make even better decisions.
- Efficiency: Even though interaction with the interface is a very cheap IT transaction cost, the costing put in place by the provider (in this case, the bank) can be high.

ARCHETYPE 6: Assets (Fiat currency, such as US Dollar)

- Activity System Content:
    a. Fiat currencies have three primary functions:
        - It is a medium of exchange,
        - It is a unit of account, and
        - It is a store of value.

    b. Fiat currency is an instrumental tool in shaping monetary and fiscal policies of a country.

- Activity System Structure: In different countries, fiat currency issued by the government is backed differently. In some countries, it is with gold and in others with trust.
- Activity System Governance: Fiat currencies are a heavily governed financial tool. It is primarily governed by the central bank of the country in conjunction with the government.
- Lock-in: It is fairly simple and straightforward to exchange fiat with other fiat or other goods and services.
- Complementaries: Fiat money is not only paper money but also the electronic money that exists in the economy.
- Efficiency: In some countries, it is not very efficient to have fiat currencies anymore due to financial catastrophes such as hyperinflation. In other countries, inflation and deflation of currency is almost always an urgent matter.

The six archetypes created were then used as the baseline models to compare each of the 80 projects. To understand the rating scheme better, it will be beneficial to go through an example from each of the seven categories.

EXAMPLE 1. Category: Lending, Project: Cream.Finance, Archetype I: Commercial Bank

- **Activity**: Cream.Finance goes beyond lending and borrowing on Ethereum. It targets a broader audience which may choose to

transact on other chains apart from Ethereum. Cross-chain composability is one of the top features of Cream.Finance. It also has its own decentralized exchange where users can trade tokens as they usually would in a secondary market. At the same time, the baseline commercial bank offers lending and borrowing services but the system is highly siloed in nature. This largely affects the flexibility of activities offered by a commercial bank when compared to that of Cream.Finance. This design element is very dissimilar from the baseline, hence a rating of 4 was given.

- **Structure**: Cream.Finance functions on top of sophisticated smart contracts. It offers a web based interface which is accessible by the end users. It is highly composable in nature, i.e. different protocols can be plugged and played with at Cream.Finance. Commercial banks tend to have a face for the customer. Their internal operations are hierarchical in nature. They would have a face-to-face brick and mortar branch, and sometimes online assistance. The structure of both is very dissimilar, hence a rating of 4 was awarded.
- **Governance**: In terms of governance, it is largely internal and centralized at Cream.Finance. However, with the baseline bank, it is internally centralized as well as externally regulated. Internal centralization is present in both the cases making them quite similar to each other, hence a rating of 2 was awarded.

EXAMPLE 2. Category: Trading, Project: HoneySwap, Archetype II: Stock Exchange and Brokerage Services

- **Activity**: Uniswap is an Ethereum-based decentralized exchange (DEX) that allows anyone to swap ERC20 tokens. Uniswap does all the activities that the baseline stock exchange does except for carrying out due diligence on each of the stocks that are to be listed on it. This actually implies that Uniswap allows anyone to list their token for trade there which is very different from a stock exchange's current model. By using Uniswap protocol, the trader is fully in control of their stocks as opposed to relying on a third party to manage them. The features and value offered to the end user is very dissimilar, therefore a rating of 4 was given.
- **Structure**: Uniswap has multiple, upgradable smart contracts that carry out all the functions autonomously. The stock exchanges are completely centralized in nature. These are complete opposites of each other and therefore, very dissimilar. Hence, a score of 4 was given.
- **Governance**: The governance at stock exchanges and brokerage services is internally governed and externally regulated. Some services also hold general assembly meetings, and operate similar to how Uniswap governance might operate. Therefore, the two governances are quite similar and hence a score of 2 was given.

EXAMPLE 3. Category: Payments, Project: Flexa, Archetype III: Visa and Mastercard

- **Activity:** Flexa makes it possible for anyone with a smartphone or tablet to spend their crypto assets at any store without worrying about fraud and conversion fees. Mastercard and Visa also make it possible for anyone to pay at stores without worrying about fraud. However, Flexa offers these services with crypto assets as a medium of exchange and the credit card companies do it with fiat currencies. The activities are dissimilar but still slightly similar, therefore a score of 3 was given.
- **Structure:** Flexa is a new way of sending money instantly, anywhere in the world. They use real-time collateralization, blockchain consensus and relationships with premier banks and exchanges around the world to make global transfers quicker than ever before. This is similar to how Mastercard and Visa work, except that they do not use blockchain under the hood. This is why a score of 2 was given.
- **Governance:** Governance at the credit card companies is largely internal and centralized in nature. A major chunk of their operations are regulated by government bodies. Flexa on the other hand uses another blockchain called Amp for its governance. This is a very different approach to governance, and hence a score of 4 was given.

EXAMPLE 4. Category: Wallets, Project: Gnosis Safe, Archetype IV: Checking Account and Physical Wallet

- **Activity:** The Gnosis Safe enables users to interact with DApps while keeping their funds secure in a multi-sig wallet with two independent devices. The multi-sig feature offered by Gnosis Safe is what makes it very dissimilar from the baseline wallet archetype. Therefore it gets a score of 4.
- **Structure:** Gnosis Safe is designed in a way that even if the project is dead, the end user will still have their assets safe. This is so not the case with a checking account associated with a bank or with a physical wallet. If the bank shuts down or if a person loses their wallet, they will lose their assets associated with them.
- **Governance:** Governance of wallets is not clear in the literature put forward by the projects. Therefore, it is difficult to compare it with the baseline.

EXAMPLE 5. Category: Interfaces, Project: Yearn Finance, Archetype V: Wealth Management Apps

- **Activity:** Yearn Finance maximizes investor's earnings by putting their crypto assets in different protocols on Ethereum blockchain to optimize returns. Wealth Management Apps offer a very similar value proposition to the end user. Their aim is to maximize yields by investing user’s assets into various financial instruments such as stocks, bonds, etc. This is why a score of 2 is awarded.

- **Structure:** The only way Yearn Finance differs from the baseline wealth management app is on the way the activities are linked. Yearn Finance carries out the investment divestment behind the scenes by deploying sophisticated smart contracts. Baseline wealth management apps use a centralized way of decision making. These are two completely different approaches. Hence, a score of 4 is awarded.
- **Governance:** Governance of wealth management apps is largely driven by the client using the app, and by the bank that is offering the service. A bank's governance also comes from its stakeholders and similar is the case with Yearn Finance. That is why a score of 2 is given.

EXAMPLE 6. Category: Assets, Project: Ampleforth, Archetype VI: Fiat Currencies

- **Activity:** AMPL is an alternative cryptocurrency that solves the problem of supply inelasticity with a simple straightforward fix: change supply over time in response to demand. The feature of contracting and expanding the supply in real time is what makes Ampleforth starkly different from the baseline fiat currency. Therefore, a score of 4 is awarded.
- **Structure:** Ampleforth is an algorithmic cryptocurrency. This means that its monetary policy is programmed in a smart contract.

This setup is completely opposite to what is found with baseline fiat currency. This is why a score of 4 is awarded.

- **Governance:** Governance of Ampleforth is driven by tokenholders. This design element is commonly seen, despite fiat currencies being regulated by government bodies. This is why a score of 2 was given.

EXAMPLE 7. Category: Scaling, Project: Loopring, Archetype III: Visa and Mastercard

- **Activity:** Loopring leverages Zero-Knowledge Proofs to render high speed, cheap transactions on-chain. Visa and Mastercard have a proprietary software that allows them to have a very high throughput of transactions. The two approaches are very different and hence a score of 4 was awarded.
- **Structure:** According to Loopring, "With zkRollups, Loopring asserts its exchanges can offer faster settlements for traders. Rather than settling trades on the Ethereum blockchain directly (as other decentralized exchanges do), zkRollups enable Loopring exchanges to complete key computations elsewhere." Linkage of activities on Visa and Mastercard is by exchanging knowledge safely and securely to settle transactions, which is a very different approach than following zero-knowledge protocols. Therefore, a score of 4 was awarded.

- **Governance:** Governance at Visa and Mastercard is driven internally as well as by its stakeholders, similar to how governance takes place at Loopring. This is why a score of 2 was awarded.

The next chapter talks about the result and discusses the main insights that are drawn from this analysis.

Results & Discussion

"Logic will get you from A to B. Imagination will take you everywhere."

— Albert Einstein

This chapter aims to discuss the results of the analysis and set the stage to enumerate the key insights that may be helpful to better understand the state of innovation in the DeFi space. This will be done by going through the *most innovative* and the *least* innovative project in every category. With this exercise, the reader will get the perspective to see the DeFi space through our lens.

Let's take a look at the average innovation score from different categories in Table 2.

Table 2. Average score based on categories

Category	Content	Governance	Structure	**SUM**
Lending	2.7	2	3.6	8.3
Trading	3.7	1.90	3.91	9.51
Payments	2.5	3	3	8.5
Wallets	2.3	-	3.1	5.4
Interfaces	2.18	1.93	2.56	6.67
Assets	3.37	2	3.87	9.24
Scaling	4	1.6	4	9.6

AVERAGE	2.9	1.77	3.43	

The highest business model innovation score among all seven categories is awarded to Scaling protocols. It appears that the most innovation is taking place with scaling solutions. The least business model innovation score among all seven categories is awarded to Wallets. Among Zott & Amit (2010) design elements, the most amount of business model innovation is with the way the activities are linked together or their 'Structure' and the least amount of innovation is with governance.

When we compare each of the categories as a whole with the baseline archetypes, 'interfaces' as a category does not seem to put forward anything largely new or radical for the end-user to consume. 'Wallets' as a category is primarily losing out because there is a lack of information communicated by the projects on the way they are governed. In this category, the linkage of activities is more innovative than the activity itself. The linkage of activity being more innovative is possible because of the underlying technology itself. Then comes 'lending' as a category which gets its edge thanks to structure. The 'payments' category unlike other categories has a higher score on the governance front. In case of 'assets', the cryptocurrencies are radically different from baseline fiat currencies because they are algorithmic in nature. 'Trading' protocols are carrying out billions of dollars worth of trading volume every single day on decentralized exchanges all thanks to smart contracts. Finally, 'scaling' projects

are proving to be game changing for blockchain as a whole because they are elevating activities offered by other categories as well.

Within the seven categories that were analysed, there is competition to innovate within a category as well. As a result, some projects are more innovative than the others. This finding is summarized in Table 10. At times, the score for the most innovative or the least innovative were the same, in that case a random selection was done to include the projects in Table 3.

Table 3. Summary of results

Category	**Most innovative**	**Least innovative**
Lending	Cream.Finance	Liquity
Trading	Uniswap	Augur
Payments	Flexa	Request Network
Wallets	Gnosis Safe	Argent
Interfaces	Yearn Finance	Dexkit
Assets	Ampleforth	DeFi Pulse Index
Scaling	Loopring	Connext

An interesting question to answer right now would be—"What aspect of XYZ project makes it more innovative than ABC projct?"

CATEGORY: LENDING — Cream.Finance (10) & Liquity (7)

The main difference between Cream.Finance and Liquity is coming from 'Content' and 'Structure' design architecture of the business model. On Cream.Finance, users can leverage cross-chain composability. Cream.Finance also has its own decentralized exchange. On the other hand, Liquity offers users to take out crypto-based loans upon provision of collaterals. Cream.Finance's structure is very flexible and highly composable in nature which allows the user to use various different protocols on Cream.Finance. Liquity does not have its own user interface. Rather, it extends its SDK and it is the developer's job to spin a user interface for their own app that uses Liquity in the background.

The governance model adopted by the two projects is very similar. Ownership of governance token gives the tokenholder a say in the future of the protocols.

CATEGORY: TRADING — Uniswap (10) & Augur (5)

Uniswap and Augur are two quite different projects from the same category. The difference between their business model innovation score is pretty high. They are different in all three design elements— content, structure, and governance.

In terms of ‘Content’, Augur has developed a betting marketplace and Uniswap is a decentralized exchange where users can trade tokens without any centralized intermediary in the middle. ‘Content’ score of Uniswap and Augur does not have a lot of difference indeed.

In terms of ‘Structure’, Uniswap has programmed sophisticated, mathematics-based automated market makers to facilitate trading. Augur’s linkage of activities is fairly novice when compared to Uniswap. On Augur, anyone can create a prediction market whose outcome is verified by unbiased experts.

In terms of ‘Governance’, Augur’s governance is completely internal and the smart contracts are designed in a way that can’t be updated. Uniswap has a decentralized governance approach, token holders vote upon important decisions that shape the future of Uniswap.

CATEGORY: PAYMENTS — Flexa (9) & Request Network(8)

Flexa and Request Network are almost equally innovative. The ‘Content’ extended by Flexa enables crypto to be used as an everyday payment mechanism. Request Network may potentially revolutionize the way invoices are settled in the industry.

The governance model on Flexa is very decentralized and risk aversive. Flexa makes use of Amp protocol under the hood. Request Network's governance is very similar to most of the other crypto project's governance. They have a native governance token that plays an instrumental role in development of Request Network.

The linkage of activities on both projects is quite different. Flexa uses real-time collateralization that enables users to pay in crypto in real-time using any PoS terminal. This model is already present with prevailing payment companies. Request Network has engineered their own consensus algorithm that is decentralized but can also be plugged within the existing financial system.

CATEGORY: WALLETS — Gnosis Safe (8) & Argent (5)

Gnosis Safe and Argent have a common governance strategy. In fact, all the common wallets have a very similar governance strategy. Most of the development is rather internal to these projects. Users do not have a direct say in the development of the wallets.

From the 'Content' point of view, these wallets are non-custodial in nature, so the user has 100% control over their assets. Argent users can operate their own Ethereum accounts. Gnosis Safe can act as a treasury platform for a DAO or a company. It's multi-sig feature requires digital signatures from multiple parties before submission of a transaction.

As far as linkage of activities is concerned, Gnosis Safe goes an extra mile to make the wallet more secure. The wallet operates completely using smart contracts that have pre-defined access control rights. Argent provides a user-friendly user interface to interact with the dapps.

CATEGORY: INTERFACES — Yearn Finance (8) & Dexkit (5)

Even though Dexkit and Yearn Finance fall under the same category, both the projects are quite different, except for their governance model. Yearn Finance and Dexkit take a decentralized approach to decision making.

In terms of 'Content', Dexkit merely aggregates prices of various crypto assets from multiple exchanges so that the user can make an informed decision on their trade. Yearn Finance aims to maximize user's (i.e. investor's) earnings by putting their locked crypto assets to use on different Ethereum protocols.

In terms of 'Structure', Yearn Finance exposes a web-based interface to the users. They have deployed various smart contracts that work with other protocols on Ethereum such as Balancer or Curve. Dexkit pulls in the price of crypto assets from nine other DEXs and presents them to the user so that they can make an informed trade.

CATEGORY: ASSETS — Ampleforth (10) & DeFi Pulse Index (5)

There is a stark difference between Ampleforth and DeFi Pulse Index. Ampleforth's features compete sufficiently with fiat currencies. DeFi Pulse Index is a weighted-index of top DeFi protocols.

Governance of DeFi Pulse Index is internal. Financial professionals call the shots. Governance model of Ampleforth is similar to most crypto project's governance. Owning a token will allow the token-holders to participate in votes.

The way Ampleforth works is unique— smart contract contracts and expands the supply of the cryptocurrencies depending upon the price of FORTH, Ampleforth's native token. DeFi Pulse Index is created using Set Protocol. As a matter of fact, anyone can create their own 'sets' or indexes using Set Protocol.

CATEGORY: SCALING — Loopring (10) & Connext (9)

Both projects, Loopring and Connext, aim to scale the Ethereum blockchain. Loopring additionally has its own DEX where traders can trade tokens.

The governance model of Connext is still very much internal. However, Connext is in the process of transitioning into decentralized governance. Loopring already has a mature community driven governance model in place.

The underlying technology behind Connext is state channels. According to their documentation, “State channels enable users to batch up normal Etheruem transactions.” Loopring uses Zero Knowledge Rollups or zkRollups. zkRollups enable Loopring to run smart contract computations off-chain making the blockchain faster.

In the next chapter, we will go through the key insights that can be drawn from the results.

Key Insights

"Thinking: the talking of the soul with itself."

— ***Plato***

The purpose of this thesis was to explore the state of business model innovation in the DeFi space on the Ethereum blockchain.

The following key insights can be drawn from the results:

1. Most of the projects are simply transferring knowledge from centralized applications to decentralized applications. This is analogous to digital transformation vs digitization. This phenomenon can be particularly observed with Interfaces. For instance, the activities offered by interface projects and baseline are largely similar, the only difference being that one of them is decentralized in nature and the other one is centralized. Dexkit is one of the projects which simply aggregates prices of various crypto assets from different exchanges. This feature is very commonly seen in the industry. This phenomenon can be observed with other projects from other categories as well. For instance, Akropolis is simply extending a user interface for investors to lock their crypto assets to earn an interest on them. Very similar to how a fixed deposit in a bank works.

2. In terms of governance, the projects are isomorphic in nature. The governance strategy of most of the projects is more or less the same. This ownership of tokens empowers tokenholders to participate in the governance and cast their votes which usually happens during a general assembly meeting. According to Snihur & Zott (2020), decentralized form of decision making hinders innovation.
3. Most of the innovation taking place is not because of the use cases but because of the underlying technology of blockchain. The 'structure' design element proves this. This design element steers the way activities are linked with one another. Blockchain enables open-finance, permissionless-finance by the virtue of smart contracts. Anyone from any part of the world with a computer and an internet connection can be a part of DeFi. However, the current state of applications on DeFi replicate the already existing centralized applications.
4. The current state of projects in DeFi validate the "imprinting hypothesis" as found in Snihur & Zott (2020). Imprinting hypothesis says that, "ventures founded under similar circumstances often have similar structural characteristics, such as design choices and practices, that tend to persist over long periods of time."

Further Research

"To improve is to change; to be perfect is to change often"

— Winston Churchill

The current state of the blockchain industry is such that it is evolving at a very rapid pace. With each passing day new projects are emerging. The more the blockchain ecosystem evolves, the more solid conclusions can be drawn. This thesis can be taken forward in more than one way.

One, researchers can acquire more latest data and continue to explore and analyse the state of innovation. Two, researchers can venture beyond the DeFi ecosystem to find out whether other verticals in crypto are innovating. Three, some of the already analysed projects may change their business model over time, therefore tracking the changes occuring in the ecosystem over a period of time may yield some interesting insights into the way projects transform themselves. Four, this thesis largely draws data about projects from project's website, documentation, whitepapers, and other reputed blogs. To extend this thesis, researchers may carry out extensive interviews not only with the end users but also with the stakeholders of the project such as their investors, top management, employees. Fifth, the idea of innovation is quite complex and abstract, giving the researcher the freedom to explore other ways to measure innovation in business models apart from Zott & Amit (2010). Sixth, the baseline archetypes defined for

the scope of this thesis can be elaborated upon further, making them more comprehensive and detailed.

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Appendix

Table 1. Analysis of lending protocols

Company	Content	Governance	Structure	Value proposition offered to the end user	Governance Model	Linkage of activities
Aave	Aave is one of the leading lending protocols on the Ethereum blockchain. It offers lending and staking services to its end users. Users may choose to lock deposit their assets to get a fixed interest rate (more safe, less yield) or variable interest rate (more risk, more return). After staking capital, users receive aTokens which are pegged 1:1 to the asset users	Aave has very sophisticated and audited smart contracts in place that dictate the terms of lending and borrowing. Beyond smart contracts, Aave has a rich stakeholder ecosystem comprising borrowers, lenders, developers, liquidity providers, token holders. Aave also has a governance forum which caters to decentralized decision	Aave has a web application interface that connects borrowers with lenders. Earlier Aave used a P2P model but that model posed problems such as lack of liquidity or no match. To overcome these problems, Aave switched over to the P2C (peer-to-contract)	3	2	4

	deposited in the first place. These aTokens act like any other ERC20 token, i.e. they can be transferred, stored, or traded freely. Possession of aTokens entitles the user to start earning interest. Aave also offers 'Flash Loans' wherein users can essentially borrow a large amount of capital without any upfront collateral. The caveat here is that the user needs to repay the loan within the same blockchain transaction.	making. Anyone can submit a protocol improvement proposal to. The proposal is then voted upon. If it is agreed upon by most of the token holders, it is implemented.	model.			
Akropolis	Akropolis professes itself to be a "one-stop-shop for decentralized savings and high-yield	Akropolis's smart contract dictates the terms of lending and borrowing. Beyond smart contracts,	Akropolis's mission is to maximize yield or interest earnings of their depositors.	2	2	4

	accounts''. Users provide liquidity to Akropolis's vaults to earn interest on their assets. Akropolis's aim is to maximize yield percentage for its users by deploying various automated investing strategies in the background.	anyone holding Akropolis token can participate in their decentralized governance.	They do so by curating sophisticated yield generation strategies which are not just limited to the Ethereum blockchain but also across other chains.			
Compound	Compound is one of the leading lending protocols prevailing on the Ethereum blockchain. It simply lets users borrow or stake their tokens. The interest earned on tokens or the interest paid on the borrowed tokens is decided algorithmically.	Compound token holders can directly participate in their governance by voting or proposing changes to the Compound protocol.	Compound Finance has a web interface that users can access. Their smart contracts are thoroughly audited. As a risk management layer, Compound has put a Comptroller smart contract in place.	2	2	4

Cream.Finance	CREAM is short for Crypto Rules Everything Around Me. CREAM goes beyond lending and borrowing on Ethereum. It targets a broader audience which may choose to transact on other chains apart from Ethereum. Cross-chain composability is one of the top features of CREAM. It also has its own decentralized exchange where users can trade tokens as they usually would in a secondary market.	At the moment, the decision making at CREAM is internal and centralized. However, CREAM is striving to move towards decentralized governance involving all the stakeholders in its ecosystem.	CREAM finance offers a web based interface which is accessible by the end users. It is highly composable in nature, i.e. different protocols can be plugged and played with at CREAM.	4	2	4
Inverse finance	The main products under the umbrella of Inverse.finance are Anchor, DOLA and DCA Vaults. Anchor connects borrowers and	Inverse finance is governed directly by the community. Token holders have a direct say in all the decisions affecting Inverse	Inverse Finance can be accessed via a web interface. In their product suite, Anchor is responsible for	2	2	3

	lenders. DOLA is their stablecoin that is always equal to one US Dollar. Users can lock their assets in DCA Vaults to earn interest.	Finance as a project.	connecting the lender with a borrower. According to the Inverse Finance white paper, "Their stablecoin, DOLA can be minted by using other assets on Anchor as collateral and can also be used itself as collateral to borrow other assets on Anchor."			
Liquity	Users can take out loans interest-free without any recurring costs. Users however have to provide collateral. In exchange, the user gets Liquity stablecoin, LUSD which can be used freely in the whole ecosystem.	According to Liquity, "Unlike other platforms, Liquity protocol does not rely on human governance to vote on monetary interventions. All protocol parameters are either preset and immutable or	Liquity does not have its own web user interface. The protocol can be accessed via third party apps, or a developer can spin up their own Liquity frontend using their SDK.	2	2	3

		algorithmically controlled by the protocol itself — making human interventions redundant."				
Maker	Maker is one of the leading decentralised lending platforms. Maker has its own stablecoin, Dai. it is pegged to the US Dollar. When a user takes out a loan from the Maker platform, they provide other crypto assets as collateral and receive their loans in Dai.	Maker has been governed by its vast user community for a very long time. All the improvement changes that are proposed by the community are put to vote by the community. This essentially gives the community more power over their assets.	Maker has a web interface accessible to everyone. Users can borrow against a variety of crypto assets. Maker smart contracts have been thoroughly audited.	2	2	4

Ramp Defi	RAMP DeFi is a cross-chain DeFi lending protocol. Users can maximize their yields by leveraging the power of different blockchains.	Governance mechanism at Ramp Defi is largely community driven. Anyone holding Ramp Defi token can participate in their decentralized governance.	Ramp Defi is a platform that is bringing cross-chain composability to the audience.The network uses liquidity on/off-ramp design. According to Ramp Defi documentation, "Tokens using a non-Ethereum standard are first converted into collateralized stablecoins (rUSD) before being used on the Ethereum blockchain. In the same manner, ERC-20 based stablecoins can be changed into eUSD	4	2	4

			for use in Ramp DeFi’s liquidity pool."			
Rari Capital	Rari Capital is focused on increasing yields, catering to users from all risk appetites. It extends a simple to use interface in which the user can make their own choices.	Rari Capital's governance mechanism is completely driven by its community. Anyone holding a Rari Capital token will have a proportional say in decision voting rounds. All parts of the protocol are designed in a way that can be modified if there is a need.	According to Rari Capital documentation, "Rari Capital is a website where users can deposit their crypto-assets and it will automatically rebalance it into the highest-yielding stable opportunities. Rari Capital leverages the lego effect of DeFi protocols to deliver the never before seen high yields for a risk-averse mechanism."	3	2	3

Vesper	Vesper deploys active strategies and algorithms ensuring yield generation while mitigating risk for our investors. They trade multiple baskets of currencies on multiple platforms all from one pool with one wallet, making it easy for users to follow their investments and growth. Vesper allows users to deposit their ERC20 (ETH, WBTC) tokens into their pools at competitive rates. Vesper's strategies then use the deposited funds for lending and investments in other DeFi platforms that are growing their ecosystems and user	Decision making at Vesper is completely decentralized. Anyone holding a Vesper token can guide the decision making at Vesper by voting.	Vesper extends a web based user interface to its users where they can stake their funds in a variety of growth pools. Vesper provides an economic engine through its token that facilitates the building and expansion of Vesper's capabilities and its community.	3	2	3

	bases.					

Table 2. Analysis of trading protocols

Company	Content	Governance	Structure	Value proposition offered to the end user	Governance Model	Linkage of activities
Augur	Augur takes advantage of its decentralized nature to create a betting marketplace. Users will be able to freely place bets on what they think tomorrow might hold (or even today). In doing so, more people will be able to monetize their knowledge and help make the world a better place.	The Augur protocol has limited governance. It essentially comprises a set of immutable contracts which can't be upgraded or modified.	Augur allows anyone to create a prediction market about any event in the world, from cryptocurrency price movements to business forecasts. The outcome is verified by impartial observers who get a slice of the winnings.	3	-	2
AirSwap	When two peers want to make a mutually beneficial trade, AirSwap allows them to do it directly on the blockchain. This peer-to-peer negotiation between parties takes	AirSwap's governance is largely decentralized and community driven. Their governance token is AST.	The platform is decentralized as AirSwap does not hold custody of user's assets. All parts of trading are executed via smart contracts.	3	2	4

	place off the chain, mutually and privately (without AirSwap ever holding any tokens).					
Balancer	Balancer is an automated market maker (AMM), decentralized exchange (DEX), and liquidity pool protocol that can be used for swapping ERC-20 assets in a decentralized fashion.	Balancer ecosystem can have a direct say in the future of the protocol. They can govern the platform by voting using the Balancer (BAL) token.	An automated market maker such as Balancer creates a fair price, enabling buyers to pick up reliable and accurate data on which assets' values are based.	4	2	4
Bancor	Bancor introduced the first Automated Market Maker (AMM) on the Ethereum blockchain back in 2017. The Bancor Network is one of the pioneering DEXs in the crypto space, allowing traders to swap almost 10,000 ERC-20 and EOS token pairs with ease.	According to Bancor documentation, "BNT token gives rights to become a member of the BancorDAO where the BNT token is also used for governance, with holders having voting rights on protocol upgrades and improvements."	Bancor is an open-source and permissionless protocol that allows anyone to convert any token directly from any token or digital currency without going through a third party exchange.	4	2	4

Curve	Curve makes it easy to trade between multiple stablecoins via its decentralized exchange.	Curve launched a decentralized autonomous organization (DAO), with CRV as its in-house token.	The automated market maker (AMM) algorithm manages liquidity by filling orders on both the buy and sell side simultaneously from other users of stablecoins through matching orders, using a pricing oracle that uses price feeds from exchanges as an input into determining the best price for an asset.	4	2	4
Dodo	DODO is a decentralized finance (DeFi) protocol. It has developed a smart contract that will provide on-chain liquidity for multiple types of assets. Built around a unique proactive market maker (PMM) algorithm, the	DODO uses a stable currency (DODO Tokens) as part of a crypto economy which enables users to get involved in governance discussions and decisions.	According to DODO's documentation, "The PMM pricing mechanism mimics human trading. It utilizes oracles to gather highly accurate market prices for assets. It then	4	2	4

	platform will match orders in an attempt to constantly offer better prices than AMMs can provide.		provides enough liquidity close to these prices in order to stabilize the portfolios of liquidity providers (LP), lower price slippage and negate impermanent loss by allowing arbitrage trading as reward."			
dYdX	dYdX is a leading decentralized exchange. dYdX supports both perpetual and margin trading (with leverage), as well as spot trading, lending, and borrowing.	dYdX is in the process of launching their governance token	dYdX enables users to carry out even advanced trades conveniently without the need of any intermediary.	4	-	4
Hegic	Hegic is a decentralized platform that allows users to buy, sell or even create their own options. Users can use their service to trade put and call options for ETH and WBTC with ease.	Governance at Hegic is decentralized and managed by their token, HEGIC.	Hegic Protocol is a decentralized protocol with on-chain liquidity pools which allows for both sides of a trade to be filled once price conditions have been met. This	4	2	4

			can be achieved through our liquidity pools and hedge contracts.			
Honeyswap	Honeyswap is a decentralized exchange (DEX) on xDai Layer 2 scalability infrastructure.	Honeyswap doesn't have a governance strategy in place as of now. The Honeyswap AMM contracts are not upgradeable.	Honeyswap users can trade at high speed, low cost, and also securely since this DeFi platform is built on Ethereum sidechain xDai.	3	-	4
Loopring DEX	Loopring will allow for fast and secure exchanges between cryptocurrencies and tokens from within existing wallets. The protocol will also allow for off-chain order books to be created - a necessity for fast and scalable decentralized exchanges.	Ownership of LRC tokens gives you the right to participate in their governance model.	zkRollups provide the solution — they allow Loopring exchanges to execute smart contract code elsewhere. This means traders experience faster settlements.	4	2	4

Mettalex	The commodities market is one of the largest and least efficient markets in the world. This leads to market failure in the form of price manipulation, front running and poor liquidity. Mettalex will be the first major application built using Fetch.ai technology to address these market failures. By using Fetch.ai's smart contracts, derivatives will be priced in real-time, regardless of size. This means reduced risk for traders and a more efficient market all round.	Ownership of MTLX tokens gives you the right to participate in their governance model.	Mettalex offers a decentralized approach where users can exchange position tokens for exposure in their selected base markets using smart contracts with little or no collateral held as security. This also allows smaller traders to gain larger positions within a cryptocurrency market with low collateral.	3	2	4
mStable	mStable is building a decentralized and non-custodial protocol for pegged-value crypto assets.	mStable's governance is community driven. Token holders of mStable can participate in their collective.	According to mStable documentation, "mStable is a smart contract system built on Ethereum. For example, if you send	4	2	4

			100 DAI to the mUSD contract, you will receive 100 redeemable mUSD back. All collateral assets are lent on several decentralised lending markets, initially Compound and AAVE. mStable assets can earn a native interest rate that is composed of interest from the underlying collateral assets plus platform fees. Finally, anyone can use mStable to swap our underlying assets at a 1:1 ratio with zero slippage."			
Opyn	Opyn is aDeFi options trading protocol that uses smart contracts to make trading Ethereum-based	Doesn't have a governance strategy in place yet.	According to Opyn's documentation, "DeFi users and products rely on Opyn's smart	4	-	4

	options easy.		contracts and interface to hedge themselves against DeFi risks or take speculative positions on different cryptocurrencies. Opyn uses 0x's unique off-chain relay, on-chain settlement architecture, to offer free limit orders to its users."			
PerlinX	Users can create synthetic assets and crypto derivatives using PerlomX. PerlinX also offers automated market maker (AMM) services.	Ownership of PERL tokens gives you the right to participate in their governance model.	Perlin Network leverages UMA's Data Verification Mechanism (DVM) to create synthetic assets. The UMA DVM is an oracle that aggregates and communicates off-chain data to smart contracts.	4	2	4

Perpetual Protocol	Perpetual Protocol is a scalable, decentralized exchange (DEX) built on xDai.	Currently, the governance of the protocol is handled by the core developer team to keep the decision-making process fast and nimble.	It is powered by Virtual Automated Market Makers (vAMM)	3	-	4
PieDAO	Launched on the Ethereum Blockchain, PieDAO will be the first decentralized autonomous organization (DAO) that provides governance structure, processes and voting rules for community based decision-making in asset management.	DOUGH is the token that governs the platform.	PieDAO is revolutionizing the asset management industry by applying blockchain technology to create smart pools and pie vaults built on top of a foundation of trustless smart contracts. Pies give everyone access to passively managed baskets of cryptocurrencies and other assets with one easy-to-manage token that they can redeem at any time.	2	2	4

Ren	Ren empowers its users to transfer crypto assets across multiple blockchains seamlessly.	REN is the token that governs the platform.	According to Ren, "To manage and execute its complex operations, the Ren software uses a custom virtual machine that deploys its smart contract code to the Ren network. "	4	2	4
Saffron Finance	Saffron is an open-source protocol that tokenizes on-chain assets, even assets such as smart contracts.	According to Saffron team, "Saffron finance is currently controlled by a team multi-sig and does not have any formal governance in place."	The end-result is that liquidity providers can now participate in multiple capital markets while maintaining full control over their risk profiles by choosing from available pools.	4	1	4
Set Protocol	Set Protocol is a platform that allows users to create and trade baskets of crypto assets.	As of now governance is centralized within Set Protocol	Users can spin up their own baskets of crypto or indexes, or trade already created indexes.	4	1	4

Sushiswap	SushiSwap is one of the leading Ethereum-based decentralized exchanges (DEX). Users can trade tokens, and earn interest through yield farming.	SUSHI is their governance token. Communities can propose improvements which are then voted upon.	SushiSwap is largely functional because of its sophisticated and audited smart contracts and liquidity provided by other traders to complete trades.	4	2	4
Synthetix	Synthetix is a leading protocol on Ethereum that issues synthetic assets.	According to Synthetix, "Synthetix was originally governed by the Synthetix Foundation, a not-for-profit foundation based in Australia, but shifted control to three decentralized autonomous organizations (DAOs) in 2020."	On the Synthetix, users can create "Synths" which track the price of an asset using decentralized oracles. Users can hold and exchange Synths as if they were actually the underlying tokens on the blockchain.	4	2	4
Uniswap	Uniswap is an Ethereum-based decentralized exchange (DEX) that allows anyone to swap ERC20 tokens.	UNI is their governance token. Communities can propose improvements which are then voted upon.	Uniswap has deployed several smart contracts that facilitate trading using AMM.	4	2	4

0x	0x is an open-source protocol on Ethereum that enables users to exchange their crypto assets using the P2P model.	According to 0x, "ZRX is 0x's native governance and staking token. Owning ZRX gives you a say in how the protocol evolves, and token holders can also stake their tokens to earn ETH liquidity rewards."	0x's hybrid off-chain relay & on-chain settlement architecture makes 0x a flexible and gas-efficient DEX protocol for developers to build on long term.	4	2	4
ZKSwap	ZKSwap is an open-source, crypto asset swapping protocol following the Automated Market Maker (AMM) model.	gZKS is their native governance token.	Through ZK-Rollup technology, uniswap can realize all functions of the public chain within Layer 2, thereby greatly reducing transaction costs without compromising on security.	4	2	4

Table 3. Analysis of payment protocols

Company	Content	Governance	Structure	Value proposition offered to the end user	Governance Model	Linkage of activities
Flexa	Flexa makes it possible for anyone with a smartphone or tablet to spend their crypto assets at any store without worrying about fraud and conversion fees.	According to Flexa, "Flexa's instant payment authorizations are made possible via Amp. Amp works as crowdsourced collateral to completely decentralized payment risk, rewarding those who provide collateral with even more Amp tokens for every successful payment transaction. Anyone can stake Amp toward apps on the Flexa crypto network, and any Amp tokens staked can be locked in real-time to secure payment transactions while they await	Flexa is a new way of sending money instantly, anywhere in the world. They use real-time collateralization, blockchain consensus and relationships with premier banks and exchanges around the world to make global transfers quicker than ever before.	3	4	2

		confirmation. In this way, Flexa can immediately guarantee payouts in any currency and directly extend the benefits of distributed ledger technology to merchant–consumer payment interactions."				
Request Network	Request allows anyone to request a payment for which the recipient can pay in a secure way. This solution allows for a wide range of automation possibilities, from paying rent on the day to every month or even hourly payments like parking.	The REQ token is Request Network's native governance token. The idea is to promote more discussions and votes on future decisions.	Request is built to handle global transactions, regardless of currency. They have written their own consensus algorithm making it simple and efficient enough to run on mobile devices within the existing financial system.	2	2	4

Table 4. Analysis of wallets

Company	Content	Governance	Structure	Value proposition offered to the end user	Governance Model	Linkage of activities
Argent	Users can keep an Ethereum account online (Externally Owned Account or EOA) but maintain control of their funds via their mobile device. It is a decentralized wallet for storing private keys and sending transactions through a user-friendly interface. The EOA holds all of its private keys in an encrypted vault so that no unauthorized access can take place.	All wallets are non-custodial in nature, i.e. the user has 100% control over the private keys of the wallet and as a result, 100% control over the funds. Governance or management from the company is very little. If the user loses their private key, there is essentially nothing the company can do to restore their funds. However, these companies have all designed their software product in a way that even if the company goes under or is not operational anymore, the	Users can have their own wallet that not only saves all their assets but also provides a better user experience by increasing the security of the wallet with special features such as recoverability, upgradability and transferability.	2	-	3
Coinbase Wallet	Coinbase Wallet makes it easier to store your assets, access decentralized apps		Coinbase Wallets is a browser extension, mobile app, and	2		3

	(DApps) and collectibles, view market information, pay friends, and send crypto anywhere around the world - all in one place.	user can easily switch from one wallet interface to another.	desktop app that provides a unified experience for sending cryptocurrency between Coinbase accounts and to non-Coinbase accounts.			
Eidoo	Users can access all the blockchains from one place, do not have to go through KYC more than once, receive rewards for holding tokens in their wallet, buy other cryptocurrencies, collect and trade non-fungible tokens (NFTs).		Eidoo offers both mobile apps and desktop clients that enables the user to interact with crypto apps easily.	2		3

Gnosis Safe	The Gnosis Safe enables users to interact with DApps while keeping their funds secure in a multi-sig wallet with two independent devices (smartphone/browser extension).		According to Gnosis Safe documentation, "Most decentralized wallets use externally owned accounts (EOAs) on Ethereum. EOAs are controlled entirely by a private key—it is the only thing that stands between the user and full control of the wallet. This means that if your private key is lost or compromised, your funds are no longer secure. The Gnosis Safe is different. Rather than using an EOA, the Safe operates entirely with smart contracts that define access control rights and enable	4		4

			more sophisticated security features."			
Math Wallet	With MathWallet you can manage all your tokens on a single platform and with multiple devices (mobile / browser extension / web / hardware wallet).		MathWallet extends various interfaces such as mobile, web, cold wallet, browser extension.	2		3
My Crypto	MyCrypto is an open-source, HD wallet for Ethereum and all ERC20 tokens. It allows you to manage multiple accounts and view all of your transactions on the blockchain. For transacting on-chain, the user has to pay the transaction fee.		My Crypto not only extends desktop app as an interface but also supports web interfaces.	2		3
My Ether Wallet	MEW is a secure online wallet that makes it easy to manage, send, and receive ERC20 tokens. With just a few easy steps, users can get started with		My Ether Wallet offers a web-based wallet as well as a smartphone application now. It makes it easy to	2		3

	it.		interact with dapps on the go.			
Metamask	MetaMask is one of the leading crypto wallets. As a browser extension, MetaMask enables access to all of Ethereum's Dapps, MetaMask will allow users to send and receive Ether (ETH), send transactions on the Ethereum network, as well as explore decentralised applications within their browser without compromising their personal information or risking their security.		MetaMask is essentially a browser extension that acts as a bridge between the user and the dapp.	3		3
Binance Wallet	The Binance Chain Wallet will enable users to manage their crypto assets with ease on Binance Smart Chain. Users can interact with a variety of dApps that are deployed		Binance wallet is a browser extension that makes it easy to interact with apps on the Binance Smart Chain, as well as the Ethereum blockchain.	2		3

	on the Binance Smart Chain.					

Table 5. Analysis of interface protocols

Company	Content	Governance	Structure	Value proposition offered to the end user	Governance Model	Linkage of activities
CoreVault	CORE is a blockchain based cryptocurrency that has a unique approach. CORE's main aim is to execute profit-generating strategies autonomously through a completely decentralized solution.	According to CoreVault's whitepaper, "In existing autonomous strategy-executing platforms a team or single developer is solely responsible for determining how locked funds are used to generate ROI. This is hazardous to the health of the fund as it grows, as it creates flawed incentives, and invites mistakes to be made. CORE does away with this dynamic and instead opts	CORE's goal is to maximize the total value locked (TVL) in their contracts so that yield for its users can be maximized. Behind the scenes, CORE uses many investment strategies that farm tokens from various other DeFi pools.	2	2	4

		for one with decentralized governance."				
DEXKIT	DEXKIT can aggregate the prices of assets from various exchanges so that you can make better decisions when it comes to buying cryptocurrencies at the best price possible. It also runs bots that identify arbitrage opportunities.	DEXKIT's governance is largely decentralized and community driven. Their governance token is KIT.	According to DEXKIT's documentation, "When trading cryptocurrencies the DEXKIT custom aggregator searches over nine DEXs to find the best price and liquidity using a Uniswap-style interface that's familiar and easy to use."	1	2	2
Dharma	Dharma is a non-custodial wallet that bridges the gap between fiat and crypto. Users can buy DeFi tokens directly from their US bank accounts using protocols such asUniswap.	Governance of Dharma is mostly internal.	Dharma extends a mobile application that can be used to convert fiat into crypto quickly.	4	1	1

dHEDGE	According to dHEDGE, "dHEDGE is a decentralized asset management platform that enables the creation of pools through smart contracts. The protocol allows investors to put their capital to work in different strategies based on a transparent track record of the investment manager."	dHEDGE's governance is largely decentralized and community driven. Their governance token is DHT.	As per dHEDGE's documentation, "The way it works is, managers can choose to verify themselves on Twitter before creating the pool. They are able to enter the name and description of the strategy for the pool. Once the pool is deployed, investors only need to deposit sUSD to receive a pool token which represents the investor's claim on the pool. As the assets are in the pool, investors can track manager performance as well as seeing the percentage of the allocated assets.	2	2	3

			Additionally, the investors have custody of their funds at all times since the pool token is redeemable to the underlying synthetic assets. If the manager's decisions are profitable, then the manager may collect a performance fee as a percentage of the overall return generated by the pool. Fees are collected in pool tokens, meaning if the manager is successful his/her overall ownership of the pool will increase over time. At last, the admin fees are taken from the pool token for the DAO."			

Enzyme	Enzyme's decentralized ecosystem democratizes the creation of asset management funds by effectively creating a crowd-sourced marketplace for investment managers. Fund managers compete to attract investors while investors select those strategies that best fit their portfolios.	As per Enzyme, "The Enzyme Finance protocol uses the MLN cryptocurrency to execute various operations on the platform."	As per Enzyme's documentation, "Using the project's web portal, users can invest in funds and portfolios launched by other users, and other users can invest in their creations."	2	2	2
Force DAO	ForceDAO changes the game and delivers better results through crowdsourced wisdom and powerful incentives for strategists.	ForceDAO governance is largely decentralized and community driven. Their governance token is FORCE.	As per Force DAO, "Core Vaults are automated yield aggregators tracking the highest performing pools and farms for BTC, ETH and stablecoins. This set of vaults are maintained by the DAO's operations team. Edge Vaults are	2	2	2

			next-gen automated yield strategies proposed by community members."			
Frontier	Frontier is a DeFi protocol focusing on data aggregation that assists users in making the best choice. It is blockchain-agnostic and supports many blockchains.	Frontier's governance is largely decentralized and community driven.	According to Frontier's documentation, "Frontier aggregates data from various chains and presents them to the user so that they can make the best choices. Frontier uses Cosmos SDK behind the scenes."	2	2	2
Harvest Finance	Harvest Finance is best suited for users looking for a way to automate their yield management. User's crypto assets are put to work to earn the highest yield.	Harvest Finance's governance is largely decentralized and community driven. Their governance token is FARM.	Harvest finance delivers its services through a web app. It is an automated yield aggregator.	2	2	4

InstaDApp	Instadapp is a decentralized application that acts as a bridge that connects several different protocols on the decentralized web. This makes it easy for the user to interact with many protocols from one place.	INST is InstaDapp's governance token.	InstaDapp is decentralized and uses smart contracts to enable the integration of other dApps.	2	2	4
Pool Together	According to PoolTogether, "PoolTogether is a lottery in which anyone who purchases a ticket has a chance to win a stash of crypto—but even if you lose the drawing, you don’t lose any of the money you spent to enter."	POOL is Pool Together's governance token.	According to PoolTogether, "Many cryptocurrencies offer a staking feature that allows users to lock up their funds within the network to provide liquidity, and they are rewarded with an interest-like staking reward for doing so. PoolTogether takes that premise and executes it on a large scale as a lottery.	3	2	2

			When users deposit funds into the pools, they are staked via the DeFi platform Compound and the interest that is generated is used for the lottery rewards."			
Sovryn	Sovryn is a decentralized protocol for peer-to-peer lending, and margin trading.	Sovryn's governance is largely decentralized and community driven. Their governance token is SOV.	According to Sovryn, "The protocol can be easily integrated into new and existing exchanges, or accessed simply through a web3 portal."	2	2	2
Value DeFi	With Value DeFi, users can join the yield management pool through flexible, optimized and profitable pool strategies that protect your community's funds by integrating an insurance treasury.	Value's governance is largely decentralized and community driven. Their governance token is VALUE.	According to Value DeFi, "There are many products under their umbrella. vSwap is an automated market maker product created by Value DeFi that utilizes smart routing to provide the	2	2	3

			best rates possible for token swaps. vPegSwap is a product made for swapping stablecoins in the most efficient way possible. Farms-as-a-Service (FaaS) is a product designed for developer teams that helps new projects with jump-starting their token's liquidity without any upfront costs."			
Vesper	Vesper deploys active strategies and algorithms ensuring yield generation while mitigating risk for our investors. They trade multiple baskets of currencies on multiple platforms all from one pool with one wallet,	Decision making at Vesper is completely decentralized. Anyone holding a Vesper token can guide the decision making at Vesper by voting.	Vesper extends a web based user interface to its users where they can stake their funds in a variety of growth pools. Vesper provides an economic engine through its token that facilitates the	3	2	3

	making it easy for users to follow their investments and growth. Vesper allows users to deposit their ERC20 (ETH, WBTC) tokens into their pools at competitive rates. Vesper's strategies then use the deposited funds for lending and investments in other DeFi platforms that are growing their ecosystems and user bases.		building and expansion of Vesper's capabilities and its community.			
Yearn Finance	yearn.finance maximizes investor's earnings by putting their crypto assets in different protocols on Ethereum blockchain to optimize returns.	YFI is yearn finance's governance token.	According to Yearn Finance, "yearn.finance is a protocol designed to deploy contracts to the Ethereum blockchain as well as other decentralized exchanges running on it, such as Balancer and Curve."	2	2	4

Zapper	Zapper is an easy to use platform that will deploy and manage all your DeFi positions. All in one place, on your desktop or mobile device.	Governance on Zapper is internal as of now.	According to YFI, "Users are trusting that YFI's contracts, as well as those in associated contracts on Balancer and Curve, will deploy on Ethereum in order to provide the advertised services."	2	2	1
Zerion	Zerion is an universal interface for all DeFi investments – allowing you to see everything from one place, invest in any asset and trade at the best rates.	Governance on Zerion is internal as of now.	As per Zerion, "Zerion tracks over 50 protocols, making it easy to find your tokens spread across multiple DeFi platforms and Ethereum addresses."	2	2	2

Table 6. Analysis of assets

Company	Content	Governance	Structure	Value proposition offered to the end user	Governance Model	Linkage of activities
Ampleforth	AMPL is an alternative cryptocurrency that solves the problem of supply inelasticity with a simple straightforward fix: change supply over time in response to demand.	Ampleforth's governance is largely decentralized and community driven. Their governance token is FORTH.	According to Ampleforth, "The Ampleforth protocol translates price-volatility into supply-volatility. This means the number of AMPL tokens in user wallets automatically increases or decreases based on price: When Price > $1, wallet balances Increase proportionally When Price < $1, wallet balances Decrease proportionally	4	2	4

			These supply adjustments are called "Rebases" and rebases occur once each day. When the AMPL network grows you'll automatically have more tokens, when the AMPL network shrinks you'll automatically have fewer tokens, but the price per AMPL will tend to cycle around $1. This novel rebasing mechanism is what allows AMPL to be used in contracts."			
DAI	DAI is a stablecoin that's backed by crypto assets and works to maintain a 1:1 value with the U.S. dollar through collateral agreements between	Maker's governance is largely decentralized and community driven. Their governance token is DAO.	According to MarkerDAO, "The Maker Protocol, through smart contracts running on Ethereum, enables	3	-	4

	multiple parties.		borrowers to lock ETH and other crypto assets, thus collateralizing it, in order to generate new DAI tokens in the form of loans."			
Defi Pulse Index	The DeFi Pulse Index is an index that monitors performance of selected crypto assets.	Governance of the DeFi Pulse Index was not clear. It is mained by finance professionals.	According to Defi Pulse Index, "Built on Set Protocol's new v2 infrastructure, DeFi Pulse Index tokens are directly redeemable for its DeFi tokens. The index's criteria to determine which DeFi tokens are included takes into account many factors. The index utilizes a capitalization weighted index where the value weight is based on a DeFi project's market cap."	2	-	3

Frax Finance	According to Frax Finance, "Frax Finance is a blockchain project featuring the FRAX token, an algorithmic stable coin that is partially collateralized. Basically, it can be minted by any individual who provides two essential tokens: USDC and FXS, which is the protocol's so-called 'share token.'"	Frax's governance is largely decentralized and community driven. Their governance token is FRX.	According to Frax Finance, "When FRAX is above $1, the function lowers the collateral ratio by one step and when the price of FRAX is below $1, the function increases the collateral ratio by one step. Both refresh rate and step parameters can be adjusted through governance."	4	2	4
Metronome	Metronome's advanced mass payment tool can be used to send MET to multiple addresses in a single transaction. This advanced approach saves time as well as fees when sending money.	According to Metronome, "Metronome will be governed by its smart contracts and users. Metronome authors plan on remaining active within the community of users and developers by continuing to grow the ecosystem with MET-enabled and	As per Metronome documentation, "Metronome consists of four fully-autonomous and cooperative smart contracts; Metronome Ledger ERC20, Auctions Contract, Proceeds Contract, and Autonomous	3	2	4

		compatible products. However, after its launch, authors will have no more control over MET than any other member of the MET community."	Converter Contract."			
mUSD	mStable is building a decentralized and non-custodial protocol for pegged-value crypto assets.	mStable's governance is community driven. Token holders of mStable can participate in their collective.	According to mStable documentation, "mStable is a smart contract system built on Ethereum. For example, if you send 100 DAI to the mUSD contract, you will receive 100 redeemable mUSD back. All collateral assets are lent on several decentralised lending markets, initially Compound and AAVE. mStable assets can earn a native interest rate that is composed of	4	2	4

			interest from the underlying collateral assets plus platform fees. Finally, anyone can use mStable to swap our underlying assets at a 1:1 ratio with zero slippage."			
Olympus	Olympus (OHM) is a new type of stablecoin called algorithmic stablecoin that maintains stable purchasing power. It is backed by 1:1 dollar.	OHM token governs OlympusDAO.	According to Olympus DAO's documentation, "Each OHM token is backed by 1 DAI in the treasury. However, tokens can't be minted or burned by anyone except the protocol. The protocol only does so in response to price. When OHM trades below 1 DAI, the protocol buys back and burns OHM; when OHM trades	4	2	4

			above 1 DAI, the protocol mints and sells new OHM. Because the treasury must hold 1 DAI and only 1 DAI for each OHM, every time it buys or sells it makes a profit. It either gets more than 1 DAI for the sale, or spends less than 1 DAI on the purchase."			
RAI	According to Rai, "RAI is a non pegged, ETH backed stable asset. RAI's monetary policy offers a couple of advantages such as flexibility, the protocol can devalue or revalue RAI in response to changes in RAI's market price."	FLX token governs Reflexer Lab's RAI.	As per Rai's documentation, "The RAIUSD exchange rate is determined by supply and demand while the protocol that issues RAI tries to stabilize its price by constantly de or revaluing it. The supply and demand mechanic plays out	3	2	4

			between two parties: SAFE users (those who generate RAI with their ETH) and RAI holders (those who hold, speculate on or use RAI in other protocols and apps)."			

Table 7. Analysis of scaling protocols

Company	**Content**	**Governance**	**Structure**	**Value proposition offered to the end user**	**Governance Model**	**Linkage of activities**
Connext	Connext is a layer 2 infrastructure that enables instant, large volume, p2p transfers on and across chains.	Connext's governance is shifting towards decentralized decision making.	According to Connext, "Connext is built using state channels. State channels enable users to batch up normal Ethereum transactions without	4	1	4

			needing to trust intermediaries. State channels do not require any external custodians or add any additional functionality to Ethereum, they simply allow existing Ethereum interactions to occur more quickly and at lower cost by putting more interactions into each block."			
Loom Network	With Loom Network, any dApps can offer a natively smooth and familiar experience in seconds without requiring users to download an app, setup crypto accounts, or pay transaction fees.	Loom Networks's governance is largely decentralized and community driven. Their governance token is LOOM.	According to Loom, "Loom's primary chain, called Basechain, uses a delegated Proof-of-Stake (DPoS) model to validate transactions and secure the network."	4	2	4

Loopring	Loopring leverages Zero-Knowledge Proofs to render high speed, cheap transactions on-chain. Using Loopring, users can essentially build their own decentralized exchanges with Automated Market Makers (AMM).	Loopring's governance is largely decentralized and community driven. Their governance token is LRC.	According to Loopring, "With zkRollups, Loopring asserts its exchanges can offer faster settlements for traders. Rather than settling trades on the Ethereum blockchain directly (as other decentralized exchanges do), zkRollups enable Loopring exchanges to complete key computations elsewhere."	4	2	4
xDai	xDai is a sidechain of the Ethereum blockchain. Users can carry out high volume transactions here for a very cheap price.	xDai's governance is largely decentralized and community driven. Their governance token is STAKE.	As per xDai's documentation, "xDai runs its own sidechain with permissionless delegated proof-of-stake based consensus with public POSDAO."	4	2	4

Polygon	Polygon is a protocol and framework for creating dApps on the Ethereum platform. It is a way to create scalable permissioned dApps on top of Ethereum.	Community governance is still not quite there yet with Polygon. However, holding MATIC tokens will ultimately allow the holder to participate in the governance model.	According to Polygon's documentation, Blockchains launched in this way are configured to benefit from the Matic proof-of-stake (PoS) sidechain, which uses a network of validators to dramatically speed up transactions and cut fees down to a minimum — while finalizing everything on the Ethereum mainchain. Polygon supports two types of chains: stand-alone chains and secured chains."	4	1	4