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Web 3.0 in the Financial Industry

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Abstract:
Every day we see new technologies emerge that have experts thinking about how effective this technology is going to be and what use cases it is going to have. The financial sector is not an exception, and many experts in this area constantly search for ways to use a newly emerged technology for the good. Web 3.0 is one of these technologies and there are many arguments about it but not enough documented material for how it could be used to benefit the industry, how it is going to disrupt the processes in the financial industry, and what challenges this all has. Thus, to fill this information gap and to explore this technology and its use cases, we will conduct qualitative surveys in the form of interviews with people with experience in Web 3.0 and knowledge of the financial industry and analyze how Web 3.0 will bring value to the industry. In this thesis, I describe the exact process of this qualitative study we conducted, present the results obtained from the interviews with field experts showing the specific areas and use cases of how Web3.0 is planned to be used in the future, the value it brings, and the challenges that could be faced, and based on these interviews I discuss other possibilities and ways to use Web 3.0 to bring value to financial industries. Eventually, this document can be used by other researchers and experts as a guide and a source of quality information on how Web 3.0 can be used by organizations in the financial industry and what is the current state with it.

Veeb 3.0 finantssektoris

Lühikokkuvõte:
Iga päev ilmuvad uued tehnoloogiad, mille üle paljud eksperdid mõtisklevad, analüüsides nende tõhusust ja potentsiaalseid rakendusvõimalusi. Finantssektor ei ole erand ning sektori asjatundjad püüdlevad pidevalt, et leida võimalusi, kuidas neid värskelt tekkinuid tehnoloogiaid optimaalselt ära kasutada. Üks sellistest uutest tehnoloogilistest on Veeb 3.0. See tehnoloogia on põhjustanud arvukaid arutelusid ja esitatud on rohkesti argumente, kuid meil puudub siiski piisavalt dokumenteeritud materjal, mis käsitleks, kuidas seda tehnoloogiat võiks tõhusalt rakendada finantssektori heaks ning milliseid potentsiaalseid probleeme ja väljakutsed see võib kaasa tuua. Selle informatsioonilünga täitmise eesmärgil ja nimetatud tehnoloogia ning selle potentsiaalsete rakendusvõimaluste uurimiseks teostati kvalitatiivne uuring. Uuring hõlmab intervjuusid isikutega, kes omavad nii Veeb 3.0 alaseid teamisi kui ka finantsalaseid teadmisi. Sellise lähenemise abil püüti analüüsida, millist lisaväärtust võib Veeb 3.0 finantssektorile pakkuda, andes seeläbi akadeemilise

panuse selle tehnoloogia optimaalseks rakendamiseks finantssüsteemis. Käesolevas uurimistöös on täpselt kirjeldatud antud töö raames läbiviidud kvalitatiivse uuringu protsess ning on esitatud valdkonna ekspertidega läbi viidud intervjuude tulemused, milles tuuakse esile Veeb 3.0 potentsiaalsed rakendusalad ning spetsiifilised rakendusvõimalused. Käesolev töö käsitleb ka seda, kuidas Veeb 3.0 kavatsetakse tulevikus kasutada ning millist väärtust see võib tuua. Lisaks on käsitletud erinevaid potensiaalseid väljakutseid, mis võivad tekkida selle tehnoloogia rakendamisel. Intervjuude tulemuste põhjal käsitletakse käesolevas töös ka täiendavaid võimalusi ja strateegiaid, kuidas rakendada Veeb 3.0 tehnoloogiat finantssektorile lisaväärtuse loomiseks. Antud uurimustöö pakub teistele teadlastele ja asjatundajatele informatsiooni ning seda võib kasutada juhendmaterjalina, selgitades, kuidas finantssektori organisatsioonid võivad Veeb 3.0 tehnoloogiat ära kasutada ning milline on selle tehnoloogia praegune arengutasand ja rakendusala.

Võtmesõnad:

Arenev tehnoloogia, finantssektor, Veeb 3.0, kvalitatiivne uuring, kasutusvõimalused, väärtused, väljakutsed

CERCS: P170 Arvutiteadus, arvutusmeetodid, süsteemid, juhtimine (automaatjuhtimisteooria)

Contents

1 Introduction

Emerging technologies impact how different industries operate [41]. Every industry, such as the financial industry, reacts to technological changes [41]. New technologies affect how a financial industry operates concerning data security, data sharing, and computational speed and can provide opportunities for improvements [41]. One emerging technology potentially impacting the financial industry is Web 3.0.

Web 3.0 is the new Internet era focused on decentralization and data ownership. With the current state of the Web, Web 2.0, we see centralization, clouds, and monolith architecture being utilized in the tech world and reflecting on financial industries; however, recently, the term Web 3.0 has started to emerge and get its attention in the field [23, 25]. It is still hard to give one definition to Web 3.0 [37], and experts from different fields perceive Web 3.0 differently [24, 23, 25]. However, the core of Web 3.0 is the concept of decentralization and utilization of blockchains which allows it to be summed up as a new era of the Internet where the applications and solutions are built on decentralized blockchains, and there is no central authority in these applications [24, 23, 37]. For example, imagine a future where individuals have direct control over their data on the internet. User information is securely managed through encrypted blockchain technology rather than being stored and controlled by central entities. This paradigm change enables users to share data selectively with multiple internet services while keeping ownership and control. This transition embodies the core of Web 3.0, in which technology breakthroughs enhance user autonomy and reshape the dynamics of digital interactions across sectors, transcending the current web landscape.

In the financial industry, Web 3.0 is commonly discussed to affect the payment processes, data access and ownership, and customer experience; however, it is unclear how and what value it can bring to the industry [26]. Web 3.0 for the financial industry refers to a web where transactions happen on a decentralized blockchain-based platform, removing the need for traditional financial intermediaries. Individuals can exchange assets and conduct transactions safely without relying on banks or other intermediaries. For this reason, in this thesis, we explore possible use cases of Web 3.0 in this industry, how this concept is expected to bring value to organizations of this industry, and what the challenges are related to Web 3.0 and the financial industry.

Therefore, we explore the overarching research question (RQ) of **How will Web 3.0 integrate into financial industries?** The main goal of this study is to gather and present information about the future of Web 3.0 in the financial sector. Therefore, this thesis explores what opportunities Web 3.0 will bring to financial industries and how financial businesses plan to utilize Web 3.0 to change their services, products, or the way they operate. To address the main research goal, we created the following sub-research questions:

- RQ1: What are the potential use cases of Web 3.0 in the financial industry?

- RQ2: What value does Web 3.0 bring to the financial industry and its customers?

- RQ3: What are the challenges related to Web 3.0 within the financial industry?

1.1 Research Contribution

To accomplish our research objective, we used a qualitative research methodology through interviews with industry experts. These interviews provided insights into potential use cases of Web 3.0 within the financial sector. Further, we filter and analyze the data gathered from the mentioned interviews. Eventually, we create a framework, which is the contribution of this thesis, which is a reference for engineers and researchers seeking to develop innovative solutions based on the Web 3.0 concept.

1.2 Thesis Outline

Background (section 2) explains current knowledge about the studied matter. The section shows the evolution of the Web and gives information about the main features of Web 1.0/2.0/3.0, and it presents use cases of Web 3.0 in general as well as known use cases in financial industries. Next, methodology (section 3) presents the steps of the methodology, the interview questions, and the structure of the interviews. It explains how people were selected and the tools used to conduct these surveys. In addition, this section also explains the data cleaning, data transcription, and thematic analysis processes that were performed. Results (section 4) present the results of implementing the approaches of Section 3. Discussion (section 5) discusses the findings and implications of the research based on the results in section 4. It presents the framework with an overview of the Web 3.0 use cases, values, and challenges in the financial industry. Finally, the conclusion and future work (section 6) present the conclusion of the thesis and discusses the possibilities of future work.

2 Background and related work

This research aims to collect information using qualitative surveys to outline the potential use cases of Web 3.0 in financial industries. Therefore, in this section, we address the general history of the Web, the transition from Web 1.0 to Web 2.0 and eventually Web 3.0, and why these transitions happened in the first place. Also, we discuss the current situation regarding Web 3.0 and its existing implementations.

It is important to note that while there are many academic papers on Web 1.0 and Web 2.0, Web 3.0 has a big gap in this matter. In the information pool related to Web 3.0, grey literature takes dominating standpoint; however, even those sources have not looked at Web 3.0 from the perspective related to financial industries and applications of Web 3.0 there, thus once again emphasizing the relevancy of this thesis.

2.1 Evolution of Web

Web 1.0 was the first implementation of the web, and it lasted from 1989 to 2005 [24]. It is the origins of the web, invented by Tim Berners-Lee, and it is represented as a read-only web where there are a small number of producers create web pages (interlinked) and a large number of customers access those web pages through browsers via the Internet [23]. The whole concept of Web 1.0 was as simple as users could only read information as it mainly included static web pages which used Hyper Text Markup Language (HTML) [37]. In Web 1.0, server performance and bandwidth were crucial; thus, many data could dramatically slow down a web page [56]. As hardware improved, new technologies emerged, and developers became more skilled, the transition to Web 2.0 happened.

Web 2.0 is the second phase in the Web's evolution [34]. The concept of "Web 2.0" originated from a conference brainstorm between O'Reilly and Media Live International[29]. In Web 2.0, the user cannot only read the content but also write, modify, and update the content online; it supports collaboration and helps to gather collective intelligence rather than Web 1.0 [34]. Web 2.0 facilitates properties like participatory, collaborative, and distributed practices, which enable formal and informal spheres of daily activities to go on the Web. In other words, it resembles major distinguishing characteristics of Web 2.0, including "relationship" technologies, participatory media, and a social, digital technology which can also be defined as the wisdom web [24]. Web 2.0 was the next generation of network services and transformed the World Wide Web network into a platform by supporting content sharing through applications such as wiki, web blogs, etc. [23] Overall, Web 2.0 has advantages like rich User Experience(UX), processing extensive data, low operating cost, and more personalization. However, Web 2.0 has certain disadvantages, such as a lack of real-time information, information disorder, and incentive mechanisms to promote valuable

content generation [29]. In addition to stated disadvantages, multiple papers [23, 37, 15, 16] emphasize security problems that come with the centralized nature of Web 2.0. Based on described features of Web 2.0, it is often critiqued and considered a transition state for Web 3.0 [15, 56].

Web 3.0 is the era of the Web we are currently transitioning into. The primary purpose of Web 3.0 is to fix and improve the constraints of Web 2.0 rather than replace it [25]. There is no single definition of Web 3.0, just like Web 1.0 and Web 2.0, but all of these are specified by the changes they bring to the world and the technologies they are built upon. Web 3.0 combines various technologies and concepts, but the base of Web 3.0 is **decentralization**, **cryptocurrency**, **stablecoins**, **tokenization**, **smart contracts**, **Decentralized autonomous organizations(DAO)**, **semantic web**, and **3D** tools.

2.2   The core of Web 3.0

Although giving a single definition to Web 3.0 is challenging, we can attempt to define it as **a decentralized and interconnected digital ecosystem that leverages blockchain, cryptocurrency, and tokens to enable secure value exchange and foster unprecedented collaboration and innovation**. Web 3.0 is feature-rich, but the summary of the main concepts and components of it is listed below:

- Decentralization - Web 2.0 uses a centralized approach and architecture for building apps which means platforms monitor and can share user data with third parties; thus, users have little control over their personal information and how it is used. However, the central concept of Web 3.0 is decentralization which means the apps in Web 3.0 are built on decentralized blockchains, and those apps are called decentralized applications (DApps). Web 3.0 DApps have no single/centralized power authority and, most of the time, are open-source [55, 18, 43]. Decentralization is enabled by blockchain technology. Blockchain is a decentralized digital ledger that stores transactions in a secure and immutable way. It enables transparent interactions without the need for intermediary actors [21]. There are many blockchain networks, but the main ones are Bitcoin and Ethereum [14] [6].

- Cryptocurrency(Crypto) - The concept of crypto was introduced in 2008 by Satoshi Nakamoto in Bitcoin Whitepaper [7]. The whitepaper proposed cryptocurrency as a form of digital money built and maintained on blockchain technologies. In the context of Web 3.0, crypto is used as a payment mechanism enabling seamless and secure peer-to-peer transactions. Currently, people and companies heavily utilize Bitcoin, Ethereum, and many other cryptocurrencies to perform payment operations.

- Stablecoins - With thousands of cryptocurrencies, the price of which depends on many aspects, there was a need to create a somewhat stable cryptocurrency, which is how stablecoins were introduced. Stablecoins are cryptocurrency prices of which are pegged to a commodity or currency like the US dollar. This allows for stable cryptocurrency, which is heavily utilized in Web 3.0 financial DApps, which we will discuss later.

- Tokenization - Tokenization is the concept of creating a digital token of something of a value that can be used for various purposes in DApps and blockchains. This concept is heavily utilized in various Web 3.0 financial solutions; for example, tokenizing art pieces and selling them on blockchain marketplaces is one of the existing uses of this concept.

- Smart contracts - Smart contracts are simply a piece of code or a function that runs when a certain condition is fulfilled, just like "if/when. . . then. . . ". In Web 3.0 DApps, they are usually used to automate specific processes and the execution of certain actions. Smart contracts can perform complex conditions, allowing them to revolutionize the web landscape.

- DAO - Decentralized autonomous organizations(DAO) are organizations that are managed by a group of people rather than with a single authority like in traditional business space. In DAOs, to make decisions, token-holders participate in voting that is performed through blockchain and recorded there. All the financial operations also happen through blockchains and utilize cryptocurrency. For this reason, this concept emerged to preserve the idea of the web with services without a single authority.

- Semantic Web - The term "Semantic Web" refers to W3C's(World Wide Web Consortium) vision of the web of linked data. Semantic Web technologies enable people to create data stores on the web, build vocabularies, and write rules for handling data [53]. With Web 3.0, previously unstructured data will be stored and recorded in a semantic context as a result of technological advancements, allowing machines, and particularly Artificial Intelligence(AI) applications, to process and comprehend the data without the need for human interaction or oversight. [24, 25, 55, 43]. Integrating AI into the web eventually means smarter technologies, better software solutions, and more quality information in the Web space.

- 3D Web - Compared to the straightforward, two-dimensional web, Web 3.0 will provide a more realistic, three-dimensional cyber world. By integrating various tools and technologies such as Virtual Reality(VR), Augmented Reality(AR), and Metaverse environments, users are expected to have a more immersive experience

on the Web [24, 25, 55]. VR and AR gained considerable popularity during the peak of the COVID-19 pandemic, and since then, they have been constantly developing, intending to be a part of the daily Web experience for many users.

In addition to these core concepts, Web 3.0 uses many others like IOT, 5G, and clouds; however, these are the core of Web 3.0, and many Web 3.0 financial applications are based on these features.

2.3 Applications of Web 3.0

Web 3.0 is an emerging technology but new solutions and applications around this technology are already being successfully utilized.

One of the areas for these applications of Web 3.0 is the education sector. As mentioned before, the Web 3.0 concept has many other technologies revolving around it, but according to the systematic review study [17], AR is more closely associated with Web 3.0 and is the most extensively used tool in the education sector which is mainly used in conducting experiments and performing designing tasks. Although we see some implementations of augmented reality in Web 2.0, for example, AR filters for photos and videos on social media, it is within the landscape of Web 3.0 that the truly transformative potential of augmented reality is poised to be fully realized. AR allows learners to utilize Web 3.0 smart e-learning environments where learners have a more natural and practical environment that keeps learners involved and motivated. In addition to AR, intelligent tutoring systems are an essential application of Web 3.0 in education. In these systems, the main focus is shifted to students with fully self-directed and self-regulating with semantic web technologies. Thus students are provided assistance and support, which enables them to tailor their studies based on their personal preferences, which eventually means that individuals can organize their learning, set goals, and make decisions about their learning process [50]. In addition, Web 3.0 VR, AR, and 3D games were successfully used in teaching languages and mathematics to students during COVID-19 and have proven to be a successful tool that also helped to keep students motivated during the learning process [11, 33].

Besides education, Web 3.0 solutions are applied in healthcare. The semantic web allows the creation of more organized health information systems that provide a more personalized experience[12, 19]. More than that, there is a concept of Health 3.0 [57], which uses the semantic web to semantically organize electronic health records to create an Open Healthcare Information Architecture. Web 3.0 decentralized solutions securely store and access patients' information to keep track of their health conditions remotely through an IoT device [38]. In addition, Web 3.0-based smart contracts and the semantic web are used to detect fraudulent health insurance claims by integrating Machine Learning and Blockchain technology [2]. In addition, IoT devices use Web 3.0 blockchain data stores combined with Machine Learning to process the data efficiently

and build smarter systems [13].

Although Web 3.0 solutions already exist in education and healthcare, it has also been considered to be used in the financial industry.

2.4 Applications of Web 3.0 in the Financial industry

Within the financial industry, the main use cases of Web 3.0 revolve around DeFi(Decentralized Finance), which is a new type of financial application that does not require an intermediary [8]. DeFi goal is about reinverting traditional financial services such as borrowing, lending, and trading built using decentralized infrastructure like public blockchain and smart contracts [45]. Having no intermediary is going to affect the speed of transactions, especially when it comes to cross-border payments, which always have intermediary interference, long transaction routes, and lengthy screening processes [39]. For instance, in January 2017, Standard Chartered Bank performed its first blockchain-based cross-border transaction, which took 10 seconds to execute for an operation that usually takes two days [46]. British bank Barclays was the first bank to perform blockchain trade operation in 4 hours which usually takes 7-10 days [5].

In addition to cross-border transactions, Web 3.0 payments are important for Metaverse implementation of financial organizations as more and more banks enter the Metaverse world [39, 4, 49]. For example, J.P. Morgan is the first bank to enter the Metaverse world and create virtual lobbies, and they see a big potential in this technology [22]. In addition to that, Bank of America has launched VR training in nearly 4,300 financial centers nationwide. This training technology will allow approximately 50,000 employees to practice a range of routine to complex tasks and simulate client interactions through a virtual environment [4]. Moreover, payment processors like Mastercard and Visa, in collaboration with Binance, which is a cryptocurrency exchange, introduced their cards to allow the purchase of Web 3.0 assets like cryptocurrency and Non-Fungible Tokens(NFT) [28, 52].

Finally, talking about Web 3.0 and the financial industry, it's impossible not to mention tokenization and Non-Fungible Tokens(NFTs). Blockchain tokens are digital representations of real-world assets which can be traded on platforms allowing people to earn money on their assets. Currently, NFTs have a big popularity among artists, writers, and various content creators [36]. Owning a blockchain token means you are a rightful asset owner in the real world. Implementing this in blockchain brings the possibility to many use cases, for example, as mentioned before, selling art pieces, music, games, etc. Also, currently, NFTs are used as the ticket to various groups that people create, be that the group of successful entrepreneurs, artists, or just a group of people sharing valuable information with limited access to it.

As we see, Web 3.0 solutions are slowly but steadily entering the financial industry and seem to have a promising future for them, which mainly depends on technological advancements and the adoption of Web 3.0 concepts as time goes on [39].

2.4.1 Related work pertaining to Web 3.0

Web 3.0 is an emerging technology, and for that reason, there is not much research done on it yet, especially related to the financial industry. However, there are research works that are needed to be mentioned. The author of the paper [32] believes that Web 3.0 may help to develop new products and services for businesses, reduce transaction costs and increase trust in interaction. In the paper [48] author proposes to apply behavioral economy and possibly bring an incentive mechanism based on crypto-enabled services. In addition, to prevent giant corporations from owning user data, the paper [54] mentions that Non-Fungible Tokens (NFT) can be used to store user assets in a decentralized manner.

The data management aspect of Web 3.0 has been researched, and the author of the paper [3] proposed a decentralized system of data management for IoT devices, where all data access privileges are stored in the blockchain and smart contracts are used to manage interactions between devices

Web 3.0 has also been researched from the perspective of education. The paper [20] talks about a Virtual Reality (VR) based application developed during COVID-19 with a holographic-based approach to ensure intuitive learning and to bridge the remote monitoring gap. In addition, Web 3.0 solutions have been proposed in the paper [10]. The author mentions how AI tools suffer from inflexibility and poor scalability because of a centralized approach, and he proposes a concept named Decentralized AI to elevate these issues.

When looking at the papers on how Web 3.0 can bring value to people in the financial industry, the paper [1] stands out. The authors mention three main ways Semantic Web can affect the industry; capabilities, performance, and new life cycle economics. When it comes to capabilities, the authors mention that by using shared knowledge models as building blocks and autonomic software techniques, we can develop more intelligent systems which will eventually improve service delivery, user productivity, and user satisfaction. Performance-wise, semantic technologies can dramatically impact labor hours, operating costs, and development time and expenses. Finally, talking about new life cycle economics, the authors state that semantic technologies improve economics and reduce risks across all stages (innovation stage, operations stage, and maintenance stage) of the solution life cycle. Eventually, semantic technology will bring cost reduction, flexibility of processes, and lower risks. In addition, several papers ([9, 51]) also mentioned cost reduction, faster transactions, and accessibility as a value brought by Web 3.0 to the financial industry.

Several papers have mentioned the problems and challenges of Web 3.0. Papers [35] and [47] mentioned security as the challenge of Web 3.0. The authors mention the lack of data transfer standards and the importance of defending smart contracts from assault, protecting hardware such as hardware wallets, and ensuring the secure movement of data across network nodes in the blockchain. The paper [42] mentions

phishing attacks in Web 3.0 and states that these will be around for some time, similar to Web 2.0. In addition, attacks on APIs are mentioned in the paper, stating that usually, decentralized applications (dApps) use multiple APIs, and vulnerabilities in one of them can cause big problems. Similarly, the paper [40] mentions various vulnerabilities related to the technical aspects of Web 3.0, such as unauthorized access and the appearance of more complicated attacks, such as SQL injections, malware, etc. Finally, the paper [9] mentions scalability issues with a large number of microtransactions and stability issues because of the experimental stages of the platforms.

3 Methodology

In order to answer the declared Research Questions, a qualitative approach was used in this research. We use a qualitative research method which means collecting and analyzing non-numerical data(text, audio, video) to understand the concept of Web 3.0 in-depth and build an outlook based on the new information and information from existing literature. The general components of the methodology applied to answer Research Questions are visually represented in Figure 1.
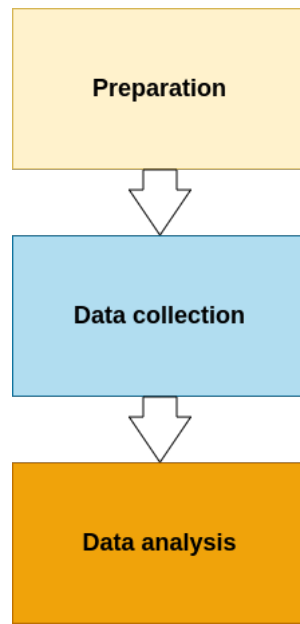
Figure 1. Methodology

The methodology has three main steps, Preparation, Data collection and Data analysis. The interview questions were developed in the Preparation phase, and interview participants were searched. Next, the Data collection phase is where the online interviews are held and recorded. Finally, the Data analysis phase contains the process of data transcription and data coding, which eventually helps us to answer the Research Questions. In the following sections, each methodology phase is explained in detail.

3.1 Preparation

The first step in the methodology for this research was Preparation. The preparation phase was carried out by constructing relevant interview questions to help answer Research Questions. In addition, finding people to be interviewed was a part of the Preparation phase of the methodology.

Below you can see the tasks performed as a part of the Preparation phase of our methodology.

Figure 2. Tasks of the Preparation phase

Further, we will expand on this diagram and describe it in detail.

3.1.1 Approach to Answering Research Questions
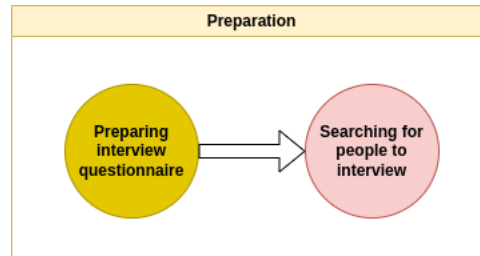
Developing interview Questions is an important part of our research. The developed questions have an open-ended structure and were structured in a way that would help us understand the opinion of experts and give them flexibility in their replies. Questions were made for experts with more technical backgrounds and those with a more theoretical basis. The question list can be seen in the appendix part of the work. The question list has two main parts, "General Questions," which are the basic questions to introduce an interviewee's background, and "Requirements Questions," which are directly related to the RQs. To address each Research Question, Requirements Questions were grouped by their relation to an RQ, thus having three categories which are "Use Case Related Questions" addressing RQ1, "Processes and Products Related Questions" addressing RQ2, and "Challenged Related Questions" which address RQ3.

To address the **RQ1** (*What are the potential use cases of Web 3.0 in the financial industry?*), the questions were constructed to focus on the use cases in the industry specifically. For instance, "What use cases of Web 3.0 do you see being developed in the financial industry?". In addition, a question like "Which services, products, and processes can be affected by Web 3.0 in the financial sector?" allowed us to capture even more use cases and help us understand how these use cases are valid with regard to certain services and processes, thus helping us answer RQ1. Moreover, mentioning already existing use cases in the financial industry mentioned in the literature or by previous interviewees helped us determine how valid and possible those use cases are and possibly expand more on them.

To address the **RQ2** (*What value does Web 3.0 bring to the financial industry and its customers?*), the question "How developing Web 3.0 solutions within financial industries will bring value to organizations?" was asked. This question allowed us to elaborate on previously discussed use cases and allowed us to elaborate on their value to the

organizations specifically. In addition to this, to research the value of Web 3.0 in the financial sector from the perspective of customers, we asked a similar question "How developing Web 3.0 solutions within financial industries will bring value to customers?" Eventually, mentioning existing ways of how Web 3.0 brings value to the financial industry by Web 3.0 to our experts allowed us to validate the existing information and possibly expand more from there.

Finally, to address the **RQ3** (*What are the challenges related to Web 3.0?*), questions related to limitations and prerequisites were asked. Examples of such questions are "What do you think are the challenges related to Web 3.0 with regard to the industry?" and "What do you think is necessary before financial solutions can be integrated into Web 3.0?". These questions allowed us to discuss the challenges related to Web 3.0 and the financial industry. In addition, a question like "What do you think are the time frames for the financial industry to develop and change solutions and services around Web 3.0?" allowed us to collect information about the time frames when the financial industry is expected to adopt Web 3.0 and develop solutions and services around it. Finally, mentioning already known challenges with Web 3.0 in the financial industry mentioned in the literature or by previous interviewees helped us determine how valid and critical those issues are.

3.1.2 Interview participants

Respondents who participated in the interviews were selected based given criteria:

- 1. Experience in the financial industry.

- 2. Experience or knowledge of Web 3.0 and its concepts.

- 3. Participants can not belong to the same organizations/companies.

Following the given requirements, we expected to obtain quality data from financial industry experts with experience or vision regarding Web 3.0. To find experts, we used social media, blog posts, and other contacts openly listed on the internet. As for social media, we mainly used LinkedIn, a social network for professional connections, which allowed us to search for experts based on the specific field and reach out to them. In addition, authors of Web 3.0 in financial industry-related blog posts were contacted through the public information listed in the posts.

Table 1 presents information about the interview participants. Code I-_ represents interviews conducted via Zoom calls, and code TI-_ represents experts who found textual responses more comfortable.

After finding the appropriate experts, we conducted interviews for the next data collection phase.

Code	Role (Domain)	Experience
I-01	CEO (Business & Computer Science)	2y 3m
I-02	Product Owner (Business)	1y 7m
I-03	CEO (Computer Science)	1y 6m
I-04	CEO, Entrepreneur (Business & Computer Science)	4y
I-05	Web3 Analyst & Investor (Business & Computer Science)	3y
I-06	Tech Lead (Business & Computer Science)	1y 5m
I-07	Co-Founder, Advisor (Business)	2y
I-08	CIO (Business)	1y 5m
I-09	Founder (Business)	2y 2m
I-10	Lead Backend Engineer (Computer Science)	1y 1m
TI-01	CEO (Business & Computer Science)	2y
TI-02	Founder(Marketing)	1y

Table 1. Interview participants
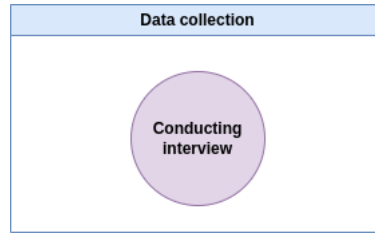
3.2 Data Collection

Figure 3. Tasks of the Data collection phase

This phase of the methodology relates to conducting interviews and collecting the data. As all the preparation was done in the methodology's first Preparation phase, the second Data Collection part was performed next. To collect the data, we performed online interviews with the experts, and as a tool for conducting those interviews, we used the Zoom platform, where all the interviews were recorded with the interviewees' consent. During the interview, the questions from the Questionnaire were asked, and the average interview duration was about 40 minutes. We used the Calendly (`https://calendly.com/`) tool to avoid time zone-related issues. The initial goal was to interview at least ten people, and if the saturation point is not reached (the experts give no new information), then find 3-5 more people. We conducted 12 interviews, consisting of 10 video and two textual interviews(see Table 1). The table shows the current position of the interview participant and their approximate expertise in Web 3.0 and the financial industry. This information is gathered during the pre-interview talks and confirmed

during the interview. All interview participants were found using LinkedIn; however, we also tried using Twitter, but no reply has been received from anyone we contacted. On average, each interview lasted for around 35 minutes; however, we had interview participants speaking well over the expected 45 minutes limit or someone talking for less than 35 minutes. After this point, we reached saturation and found that all subsequent ideas were repetitive. As the data collection phase ended, we moved to the Data analysis phase.

3.3 Data Analysis

The last phase of the methodology is Data Analysis, where recorded data was transcribed and coded using thematic analysis.
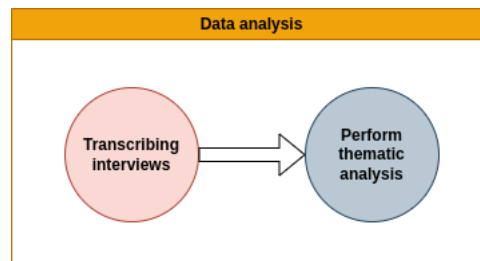

Figure 4. Tasks of the Data analysis phase

Initially, interviews were transcribed using an online tool `otter.ai`, and all the errors in the transcription were manually fixed. In order to perform data analysis, data coding was performed over the transcribed dataset. The total number of pages of all the transcripts was 117, with the average length being 9-10 pages. As for the coding method, the thematic coding method was chosen to get codes from the data analyzed. To make it easier to track the themes and quotes from the interviewees, we used the Miro [31] tool, which allows us to create interactive boards and track things easier. Below, in Figure 5, you can see how the Miro board is used for grouping themes for Decentralized Finance(DeFi), and in the same manner, the other results were grouped.

Firstly, we derived initial themes from the related work and existing literature about Web 3.0. For each RQ, we came up with an initial set of themes. For RQ1 (What are the potential use cases of Web 3.0 in the financial industry?), these themes are **"DeFi", "Payments", "Tokenization", "3D World"**. After analyzing the data, we created tags that represented the meaningful patterns of the transcribed dataset and grouped them under the themes. The theme with the biggest number of tags was "DeFi"; some of the tags we extracted are **"Lending and Borrowing", "ReFi", and "Commodities Finance"**. For "Payments," we extracted tags such as **"Remittance", "Round-up savings"**. The concept of "Tokenization" also was heavily mentioned in the interviews in the use cases of **"Fractional ownership"**.

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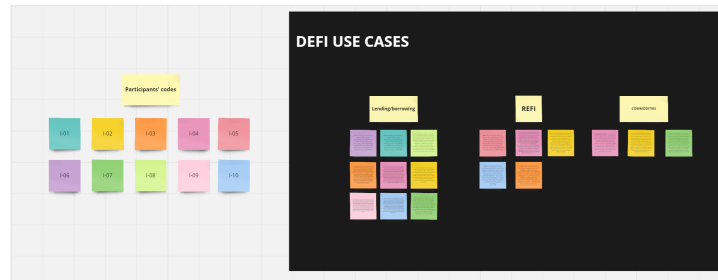
Figure 5. An example of Miro usage for grouping themes and quotes

For RQ2 (What value does Web 3.0 bring to the financial industry and its customers?), the set of initial themes was **"Decentralization", "Security", "Efficiency," and "Accessibility"**. After analyzing the dataset, we came up with another important theme often mentioned by the experts; **"Incentives"**. In addition to that, we've realized that most of the themes are a derivative of "Decentralization" thus, we decided to remove it and sort out tags related to it into different themes, leaving us with the final set of themes as **"Security", "Efficiency", "Accessibility", "Incentives"**. Some example tags extracted for each theme are **"Data control and ownership", "Lower transaction costs", "Greater financial inclusion", "Participate to earn"**.

For RQ3 (What are the challenges related to Web 3.0?), initial themes were **"Regulatory", "Technical", "Adoption"** After getting familiar with the dataset, the themes stayed the same; however, we came up with numerous tags such as **"Decentralized credit score", "Lack of tools", "Lack of education"**.

All the tags presented in this section are only a part of the whole set of tags for each theme. Further in the **Results** section, we will present more in-depth results from the data analysis.

4 Results

This section provides a comprehensive overview of the data collected and analyzed and presents the results of the thematic analysis. This section aims to report the study's main findings and discuss how these results answer our RQs. Each subsection presents the findings for each research question and is accompanied by several tables that help to illustrate the findings and by direct quotes from the interview participants to support the findings.

4.1 Web 3.0 use cases in the financial industry

This section presents the results on Web 3.0 use cases which was the focus of the RQ1(What are the potential use cases of Web 3.0 in the financial industry?). The interviews provided comprehensive data regarding this research question, and these were grouped into four categories; DeFi, Payments, Tokenization, and 3D World. Table 2 illustrates the result of the data analysis related to the use cases related to the RQ1. We can see that DeFi and Tokenization categories have the most potential use cases mentioned by our interview participants, whereas 3D is the category least mentioned. Further, we will discuss each finding and provide supportive interview quotes.

Category	Use Case	Mentions	Percentage	By
DeFi	Lending and borrowing	12	100%	all
	Regenerative finance(ReFi)	5	42%	I-01,04,05,08,09
	Commodities	3	25%	I-01,04,08
Payments	Remittance	11	92%	all except TI-02
	Round-up savings	4	33%	I-02,04,05,07
Tokenization	Physical asset tokenization	12	100%	all
	Fractional ownership	7	58%	I-01,02,03,04,05,08,10
	Storing user assets and info	3	25%	I-01,06,10
3D	Virtual bank spaces	4	33%	I-01,04,05,07

Table 2. Use cases

4.1.1 DeFi category use cases

Decentralized Finance (DeFi) is an emerging model of financial services that utilizes crypto and blockchain technologies. DeFi strives toward constructing an accessible and equitable financial infrastructure that operates using blockchain technology. Doing so gives individuals greater sovereignty over their assets, allowing them to participate in numerous financial operations without being dependent on traditional mediators such as banks. DeFi has various specific use cases, and our interview participants mentioned them during the interviews. For example, the use case of DeFi in **lending**

and borrowing was mentioned. Borrowing and lending in DeFi are similar to respective operations in traditional banks. However, the main difference is that it uses peer-to-peer(P2P) decentralized applications(DApps) instead of a centralized authority. The interview participant I-06 said: *"DeFi borrowing and lending is similar to borrowing and lending money with your friends, except instead of exchanging cash, everything is enabled by the decentralized web, and all of that bypasses banks, is faster, and easier"*. Within this financial infrastructure, lenders provide their assets to a shared liquidity pool that allows borrowers to access funds based on predefined guidelines and collateral requirements. Interest rates are typically determined by supply and demand dynamics resident in the lending/borrowing platform, while smart contracts confirm the details of loans, eliminating intermediaries. Using smart contracts guarantees transparency and security throughout the lending/borrowing process. Consequently, lending and borrowing operations similar to the ones in the traditional financial system become achievable within Web 3.0. This use case has been implemented on DeFi platforms, allowing users to perform lending and borrowing operations utilizing cryptocurrencies.

Another emerging use case of DeFi mentioned in the interviews is DeFi for the **commodities market**. The foundation of global supply chains rests on tangible assets traded in the commodities market- commonly known as commodities- comprising unprocessed goods or primary products essential for several industries. Investors trade precious metals, energy resources, agricultural produce, and other raw materials through exchanges worldwide, stimulating economic activity across borders and oceans. As interviewee I-04 stated: *"My project is basically taking gold and silver stable coins, using them as the collateral for the minting of tokens that are used for trading commodities. And we get the pricing for the commodities tokens off-chain using open APIs, and we aggregate them to come up with one price. And if somebody wants to place a bet on oil, for example, they say oils 100 dollars a barrel, and they take the 100 dollars of PAXG or XAUT, they deposit that in the vault, and they get there, they get their oil token. And when it reaches its price target of say 200 dollars because of some important political decision, then they cash out, they get their liquidity back"*. This particular use case is an extension of previously mentioned lending and borrowing actions using blockchain; it brings commodities into blockchain and allows performing operations. All in all, DeFi enables the creation of decentralized trading platforms that can provide greater access to commodities markets, provide financial sovereignty, and make it possible for investors to trade and manage their positions in the blockchain.

ReFi (Regenerative Finance) is another emerging use case of DeFi in the financial industry. ReFi is a movement focused on creating financial systems that promote sustainability and social justice. Regenerative Finance represents a compelling shift away from traditional methods used in DeFi. The main idea of Regenerative Finance is to transform financial systems and practices to prioritize sustainability, social equity, and environmental regeneration, aiming to create a more inclusive and regenerative economy. By

merging DeFi's tenets with sustainable development goals, ReFi intends to redefine our perception regarding money while developing a more comprehensive, environmentally conscious financial outlook. A ReFi project that our interview participant participates in creates tokens that reward businesses for reducing their carbon footprint. The token could be traded on a DeFi platform, providing liquidity and market access for participants. As interviewee I-03 explained, *"Most people do not get excited about DeFi. But a lot of people can get excited about saving the environment. And what if we can start to reward businesses for tracking, you know, the carbon they add to the environment on a daily basis? Our ReFi project aims to do exactly that with organizations and their ESG reports"*. The interviewee explains that their ReFi project brings carbon credits to the blockchain to enable transparent and verifiable tracking of carbon reduction efforts, incentivizing participants to take measurable actions toward addressing climate change. On-chain, you can easily trade, buy/sell, and keep track of the carbon credits, knowing they are being used correctly. In the example of carbon credits, it often happens that those get lost in the traditional bureaucracy, and it is hard to track them. With blockchain, tracking them and seeing where they have been used is easy. In addition, with carbon credits, we often see the issue with double counting, which means that a single carbon credit is being claimed by two entities [27]. Bringing carbon credits on-chain allows to eliminate the possibility of double counting. Several emerging ReFi projects focus on various aspects of environmental actions. DeFi can play a critical role in this movement by enabling the creation of new financial products that incentivize sustainable behavior and support environmentally conscious businesses. This type of system directly incentivizes businesses to reduce their environmental impact and can help promote sustainability in the broader economy. Currently, the ReFi movement is just at the beginning of its life, but specific projects are already working on reforestation or creating sustainable water supplies.

4.1.2 Payments category use cases

Payments are a prominent category of services in the traditional financial industry; however, it is also a broad category with various use cases that could be implemented in Web 3.0. Based on the literature, we know that cross-border transactions are one of the primary use cases already being implemented in Web 3.0; however, our interview participants mentioned a few more potential use cases related to the Payments category. **Remittance** is a significant use case mentioned by many experts, which refers to sending money from one person to another, usually across borders or to a foreign country. Our interviewee I-03 says: *"So, remittance is the biggest thing blockchain can help with, cutting out the middleman and decreasing the high fees we see with traditional businesses. You can now send money abroad for just pennies on the Ethereum network, for example. What used to take us days and had crazy fees, 3-5 percent to send money from the US to Mexico, for example, is now possible at much cheaper fees and is way faster"*. Remittance

is often referred to as "cross-border payments" and this is what interview participant I-09 says about it; *"Cross border payments are a perfect use case for blockchain because it is faster and cheaper compared to traditional methods like Western Union or wire transfers that can take days or even weeks. With Web 3, you can send stablecoins in seconds to anyone across the world without the hassle of dealing with banks and their slow processes".* All in all, remittance is the use case that brings traditional cross-border payments to the blockchain by utilizing crypto and stablecoins that's starting to be actively used nowadays as companies hire more remote workers and often from another country.

Another use case of how payments can facilitate traditional finance and bring it to Web 3.0 is through **round-up-savings**. The interview participant I-07 talks about it as *"I think we're seeing, you know, a lot of really cool things happening in just what I call the shop to earn or consume to earn space, there are apps out there that let you for example, accumulate your crypto roundups as you're shopping, and then those purchases go into a savings account generating interest for you. This could be a thing".* This integration of round-up savings into the Web 3.0 payment infrastructure offers users a convenient way to save or invest their funds during everyday transactions, enabling them to grow their wealth, participate in the decentralized financial ecosystem, and leverage the benefits of blockchain technology. This innovative approach blurs the boundaries between spending and saving, creating new opportunities for individuals to engage in wealth-building and financial empowerment actively.

4.1.3 Tokenization category use cases

Tokenization is one of the core functions of Web 3.0 when it comes to the financial industry, which creates opportunities for various use cases. The most common use case mentioned by our interviewees is the **usage of NFTs(Non-Fungible Tokens) for physical asset tokenization**. An NFT refers to a distinct cryptographic token that represents a unique digital asset or content with individualized characteristics, rendering it non-interchangeable with other tokens on a like-for-like basis. Our expert I-01 mentioned the creation of NFTs of real-world assets; *"We're using NFTs to tie physical assets to a digital one. Those physical assets are usually something like expensive watches, cars and etc. We then upload it to our platform, allowing people to buy or sell them or have* **fractional ownership** *over them, which is one way we use NFTs. People are also using NFTs to sell art, and there is a demand for it on platforms like Kraken and Opensea".* As seen from the interview, **fractional ownership** of assets is one of the use cases of tokenization in the financial industry. It is advantageous because it increases accessibility by allowing people to invest in high-value assets with less money. It also allows for portfolio diversification and may even enable secondary markets to provide liquidity, ultimately democratizing investment opportunities and lowering financial barriers.

Another interviewee, I-02, talks about the potential of tokenization and NFTs from

his experience with the project he worked on. *"We have used NFTs to tokenize palm trees, and people could learn royalties when the tree was harvested. We are working on a project that would be a similar thing with the real estate and people renting it out".* The interviewee mentioned that they used NFTS to tokenize ownership of a palm tree, and later a person who owned the token of a palm tree profited when the tree was harvested. Further, the interviewee mentions that they are planning to use this approach to tokenize houses where people could profit from renting them if they were a token holder or even could sell them. Currently, some platforms, such as RealT `https://realt.co/`, buy US property and divide it into digital tokens (ArmmTokens) on the Ethereum blockchain. They allow investors to purchase these tokens and become fractional underlying property owners. Rental income generated by the property is distributed to token holders proportionally, providing them with a passive income based on their ownership percentage. This platform aims to make real estate investment more accessible to people worldwide by leveraging blockchain technology. Projects like this are slowly emerging as Web 3.0 technology grows, bringing more stakeholders and customers.

In addition to physical asset tokenization and fractional ownership, interview participants mentioned that tokenization could be used in the financial sector as a way of **storing user assets**, providing higher security levels. A few interviewees mentioned this use case of tokenization, and quoting I-10; *"By using blockchain, we can open up the possibility of securely tokenizing and storing a variety of financial instruments. You know, conventional assets like stocks and bonds and unique digital assets and even user information can be tokenized, giving people full control and transparency over their money".* This use case enables true data ownership and creates opportunities for concepts like watch to earn and participate to earn, which we will discuss later. The author of the paper [54] proposed a similar use case, and observing the experts' affirmation regarding the feasibility of this particular utilization scenario is encouraging.

4.1.4 3D World category use case

When discussing Web 3.0, we refer to the combination of 3D technologies like AR/VR as "3D World", which are part of the whole Web 3.0 ecosystem. Although it is the youngest technology we have mentioned so far, our experts mention **virtual bank spaces** as one of the possible use cases in the financial industry. Our expert I-07 says, *"We will be able to do many things in Metaverse with banks. We could get assistance from the employees, not have to leave our houses, and not have to deal with all these bull**t chat boxes. We could maybe even do some transactions after a face-to-face conversation in the virtual space. It is the youngest technology among all Web 3.0 tech, but it has the potential to make interactions with financial institutions more accessible.".* However, some of the experts had no positive expectations regarding this concept. Interviewee I-05 said; *"I'm struggling to see how Metaverse can be used in the financial industry. Maybe somewhere*

in gaming or somewhere else, but in the financial industry? I don't know. We have a few examples of virtual bank spaces, but who needs it if a regular web chat is less effort with the same result.". As seen from interview results, use cases of Web 3.0's 3D concepts in the financial are limited for now, but as technology gets better, we might see some applications of it emerge in the industry.

4.2 Web 3.0 values in the financial industry

When talking about the migration from Web 2.0 to Web 3.0 in the financial industry, we need to look into why this should happen in the first place. More specifically, we need to look into "What value does Web 3.0 bring to the financial industry and its customers?" which is precisely what our RQ2 is. All in all, interview participants were eager to talk about Web 3.0's values to the financial industry; thus, we have plenty of values our experts found important. Table 3 represents the finding of the data analysis process where values are categorized into four categories, **Security, Efficiency, Accessibility, and Incentives**, each of them having a set of specific value-bringing areas. Further, in sub-sections, we will discuss each category and explain its values. Quotes support subsections, making it easier to understand the interviewee's point regarding a particular idea.

Category	Value	Mentions	Percentage	By
Security	Transparency	12	100%	all
	Reduced reliance on intermediaries	10	92%	all except TI-01,TI-02
	User asset ownership	8	66%	I-02,03,04,05,06,07,09,TI-01
	Anonymity	7	58%	I-02,03,04,06,08,10,TI-02
	Reduced risk of fraud and cyber-attacks	3	25%	I-02,06,09
Efficiency	Faster transactions	11	92%	all except TI-02
	Lower transaction fees	11	92%	all except TI-02
	Automation	5	42%	I-02,03,06,08,TI-01
	AI assistance	5	42%	I-01,03,04,08,TI-02
Accessibility	Greater financial inclusion / Portability	8	66%	all except I-01,02,TI-01,TI-02
	More democratic financial system	5	42%	I-01,04,05,07,08
Incentives	Watch to earn	5	42%	I-01,02,04,06,09
	Participate to earn	3	25%	I-04,07,10

Table 3. Values of Web 3.0 to the financial industry

4.2.1 Security related Web 3.0 values

Web 3.0 is built around many complicated and important tools and concepts; however, decentralization is the main one that makes up the idea of Web 3.0. One of the most commonly mentioned values of Web 3.0 in the financial industry is the derivative of decentralization; **transparency**. Our interview participant I-09 says: *"With Web 3.0 and its decentralization, you have this transparent infrastructure of a blockchain. You can see all the transactions on the blockchain, you know that they are immutable, and there*

is no single point of failure. All of this is security that Web 3 brings to the financial world.". The interviewee mentions transparency as one of the values that Web 3.0 and its decentralization concept bring to the financial industry allowing it to keep track of the transactions and be sure about their immutability.

Another value related to the security category and derivative of decentralization is **reduced reliance on intermediaries**. Interviewee I-01 mentioned it in this way *"...and also now with blockchain everything is peer-to-peer so you're not dependent on the middleman...".* This value is one of the core ones that blockchain brings, resulting in other values, for example, related to efficiency.

The third most commonly mentioned value of Web 3.0 to the financial industry is **user asset ownership**. The whole concept of owning your assets came with decentralization and blockchain. *"The value is you hold your asset, this is the first time you've been able to actually have custody of your asset and earn a yield on it at the same time. In traditional finance, you have to give your asset, your gold, your stock to another party, and in decentralized finance, I hold on to it myself so I don't have any counterparty risk"* - is how the interview participant I-02 brings up this value in the conversation. In traditional finance, intermediaries hold your assets which comes with various risks, whereas the usage of decentralized blockchains removes these intermediaries, and the assets are owned by the users themselves.

When it comes to risks, in traditional finance, it is easy to track your transactions and see how much money flows from and to you; however, **anonymity** is one of the values of the decentralized web, which heavily affects the financial industry. Interviewee I-04 says *"Anonymity is what's important to me, and Web 3.0 enables that. Nobody can track how much money I have or who I transferred my funds to, which makes me feel more safe and more secure. In Russia, people get sentenced to prison for donating to the Ukrainian army during the war. Blockchain, however, would prevent this and provide anonymity and security.".* This interviewee brings up anonymity as an important feature of blockchain and Web 3.0 specifically for him; however, six other interview participants mentioned this feature of Web 3.0 being an important thing for the financial industry.

Finally, the last value point of Web 3.0 to the financial industry extracted from the data analysis process is **"reduced risk of fraud and cyber-attacks"**. This value is more of a result of the decentralized nature of Web 3.0, and our interview participant I-06 mentions it like so; *"The nature of blockchain is meant to be fraud-proof if that's the term to use..each transaction is recorded on the blockchain and the community is playing a big role in this...".* However, further in the sentence, the interviewee mentions that even blockchain has its vulnerabilities and risk factors; *"...but as always, it's a new technology, there is also a human factor to it so that things will happen anyways. We already see that happening with all these crypto NFT scammers".* Blockchain technology creates a more secure system; however, as with every new technology, there are issues, vulnerabilities, and the basic human factor that inevitably leads to fraud.

In summary, the security category of values that Web 3.0 brings to the financial industry ended up being the biggest one, having five points mentioned by multiple interviewees. All of them are descendants of decentralization and are correlated. The decentralized nature of Web 3.0 enables a safe and transparent environment without intermediaries where customers are indeed the owners of their assets. However, the following sections will discuss the challenges related to this.

4.2.2 Efficiency related Web 3.0 values

Regarding values related to the efficiency category, Web 3.0 brings quite a few of these to the financial industry. **Faster transactions** and **lower transaction fees** are two ways Web 3.0 can create value for the industry. Previously interviewee I-01 mentioned reduced reliance on intermediaries and continued his sentence as *"...so you're not dependent on the middleman...and it brings speed, you'll have quicker transactions. Plus, there's going to be much lower costs. You know, when you're in defi, and you're doing transactions, and whether it's swapping in and out of different protocols, or like I said, borrowing and lending, the transaction fees are minimal, you know, banks charge a ton."*. Notably, these two values mentioned by interviewees are enabled again by the decentralized nature of Web 3.0 and the utilization of blockchain. The expert TI-01 writes *"Web 3.0 can bring significant value to customers in the financial industry by enabling greater transparency, security, and accessibility. For example, DeFi platforms built on Web 3.0 technologies allow customers to access financial services without the need for intermediaries, such as banks or brokers. This results in lower fees, faster transactions, and greater control over assets."*. As we see, blockchain allows transactions to happen faster with lower fees which is a huge value addition to the customers and organizations of the industry. Reducing operational costs benefits institutions, and giving fewer fees benefits the customer.

Touching upon Web 3.0 and its financial aspects, it is impossible to deny the value of **automation** that smart contracts bring to the industry. Almost half of our interviewees mentioned **automation** as an essential value brought with Web 3.0. Expert I-08 says *"...and we have smart contracts that allow automating processes on web 3...and it is not just a regular payment process, those contract can have very complex logic and they can have access to various real-time APIs which opens a possibility to a spectrum of complex conditions and cost-savings...we don't have that in our current financial system"*. The interviewee mentions how smart contracts can be used to perform automation with complex logic and save operational costs on processes that had to be performed manually before. Currently, smart contracts are possible on the Ethereum network and are the primary enablers of complex DeFi operations, token trading, etc.

Finally, the last value of Web 3.0 to the financial industry identified from our interviews is **AI assistance**. Our expert TI-02 wrote about AI assistance from his perspective: *"The combination of semantic web and AI and ML tools will allow us to create products better than before. We will have better recommendations system compared to what we*

have now, we will have better AI bots to help us in case we need help which already is a massive plus to the complicated financial industry. Also, a big chunk of content moderation on social platforms could be done with more intelligent AI systems". The interviewee discusses how AI could potentially bring value to the industry in certain areas by combining algorithmics and the semantic web feature of Web 3.0. Recommendation tools and assistance in DeFi platforms or token marketplaces would be a great addition to the user experience in Web 3.0. Moreover, moderation of the transactions could potentially happen with the help of AI, which could reduce the rate of fraudulent operations.

4.2.3 Accessibility related Web 3.0 values

Moving onto the next category of values that Web 3.0 brings to the financial industry, we encounter the category of **accessibility**. The value of a **greater financial inclusion** has garnered notable prominence in our interviews. *"If you're able to bank the unbanked, there's going to be greater possibilities and more customers, and it just creates a more level playing field for everybody"* - is how the interview participant I-05 mentioned this value case, specifying that this is beneficial for both customers and the industry service providers too. **Portability** is also one way our interviewees referred to this value case. Interviewee I-03 states: *"That is probably the most important thing, portability to the legacy banking.... and all you need is an internet connection, and you can be a part of the decentralized financial system.".* As per world bank [58], in 2021, the number of unbanked people reached 1.4 billion. Not having to go to a central authority like in a traditional financial system enables the portability of the financial industry, which means people all around the world that can not, for some reason, access a bank can still create a financial ground for themselves. DeFi and other Web 3.0 implementations of financial services could bring the financial to people that do not have access to traditional financial institutions and reduce the number of unbanked people globally.

Another value related to accessibility mentioned by almost half of our interviewees is **having a more democratic financial system.** This objective is enabled by the development of blockchain technology, which profoundly alters conventional financial systems. Blockchain allows anyone to engage in financial activities by utilizing decentralized networks and smart contracts, eliminating the need for middlemen, and enabling peer-to-peer transactions. Interviewee I-08 states: *"Yeah, think about it, it just...it's democratizing financing. So previously financing, you'd have to go to a bank, and you probably go talk to an old man who's going to judge you. Now, in decentralized finance, if you've got the credibility, if you've got the money, and they want to work with you, there's no stopping, you know, doesn't matter what color skin you are, what age you are, you're allowed to participate.".* The interviewee talks about how blockchain equalizes opportunities for everyone in the financial world. Furthermore, interview participant I-07 talks about this case giving a more specific example: *"In the country we have accredited investor laws.*

Are you familiar with these laws? It's a bunch of nonsense that just says if you're rich, you can get the best investments. If you're not rich, they have to be approved by the SEC. With Web 3.0 and blockchain, you'll get more opportunities and not be dependent on this type of stupid laws.". This interview participant mentions a certain regulation in his country that limits who is allowed to be an accredited investor; however, he claims that blockchain and Web 3.0 will create a more democratic financial system where similar to these laws will not limit people's ability to participate in the network. In the traditional financial system, the central authority chooses who is worthy of performing actions like borrowing money. It is done by applying strict criteria and relying heavily on credit scores, which can be biased and exclusionary. As a result, many individuals and businesses, especially those in developing countries or with limited financial history, are often left underserved or completely excluded from accessing financial services. Web 3.0's decentralized nature, powered by blockchain technology and smart contracts, has the potential to reshape this paradigm. This democratization of finance extends beyond access to credit and includes participation in investment opportunities previously limited to a select few.

4.2.4   Incentives related Web 3.0 values

This category of values is unique to the emerging concept of Web 3.0. As previously mentioned, in the era of Web 3.0, users will have full control over their assets and the information they would like to share with the organizations, and this idea also applies to the advertisements industry. More specifically, users are expected to have full power to decide if they wish to see certain advertisements or not, and this comes with the idea of introducing incentives to users for viewing these ads, and this is where **watch to earn** and **participate to earn** comes into the conversation. Interviewee I-04 gives his thoughts about this concept: *"...this's where web 3 gets really interesting because now we're moving into this new space where the consumer is going to be able to profit from their eyeballs. So what does that really mean? Well, where I think that this is all headed, is pull it up to a new economic system, which is called participate-to-earn economics, which basically leverages all of this new blockchain decentralized innovation, you know, web 3 technology and enables participants to be compensated for contributions that go beyond traditional labor and investment.".* Interviews also revealed that the concept of watch to earn economy in Web 3.0 might have a big positive effect on migration from Web 2.0 to Web 3.0. Interviewee I-06 says: *"Watch to earn is going to be a game changer in the financial industry. This will make organizations and companies rethink their whole strategy of advertisements and, in my opinion, will make it easier for people to accept decentralized web as a new standard".* Web 3.0's watch-to-earn model aims to change that by offering users the option to share their data with advertisers in exchange for rewards voluntarily. When users opt into this system, they can watch advertisements or interact with content, and in return, they receive cryptocurrency tokens or other digital

assets as compensation. This approach is better for both users and advertisers. Users gain more control over their data, are compensated for their attention, and can choose which ads or content they prefer to engage with. Conversely, advertisers have access to more relevant and willing audiences, resulting in potentially higher conversion rates.

4.3 Web 3.0 challenges in the financial industry

Until now, we have talked about the use cases of Web 3.0 and which benefits they bring to the financial industry, but it is essential to explore and discuss the challenges related to migrating financial services into Web 3.0 and adopting Web 3.0. Our last research question addresses this by answering the "What are the challenges related to Web 3.0 within the financial industry?" question. Our interviews revealed plenty of challenges related to Web 3.0 in the financial industry, and Table 4 illustrates their summary. As previously, the challenges are grouped under three categories; **Regulatory**, **Technical**, and **Adoption** challenges, with each category containing 2-4 specific challenges mentioned by interviewees. Further, in subsections, we will discuss each category and its challenges in detail and bring out the quotes from our interviews to support our findings.

Category	Challenge	Mentions	Percentage	By
Regulatory	Central governance	12	100%	all
	AML/KYC frameworks	9	75%	all except 07, TI-01, TI-02
	Customer protection	7	58%	I-01,02,03,06,08,10,TI-01
Technical	Scalability	10	83%	all except TI-01, TI-02
	Lack of tools	7	58%	I-01,03,04,05,06,07,10
	UI/UX	7	58%	I-01,02,03,04,07,10,TI-01
	Absence of credit score framework	6	50%	I-03,04,05,06,07,10
Adoption	Lack of education	10	83%	all except I-03,TI-02
	Resistance from traditional institutions	5	42%	I-02,05,06,10,TI-01

Table 4. Challenges of Web 3.0 in the financial industry

4.3.1 Regulatory challenges of Web 3.0 in the financial industry

Throughout our extensive interview process, the challenges surrounding Web 3.0 within the financial industry emerged as a prominent topic of discussion. The interviewees provided valuable insights and perspectives, enabling us to thoroughly explore the intricate landscape of obstacles that arise when integrating financial services into Web 3.0.

The main challenge that every interviewee mentioned during the interviews was **central governance** of Web 3.0. However, interview participants discussed this challenge from different perspectives; for example, interviewee I-05 says: *"Regulators are a big pain in the ***. But here's the weird the problem is and why the regulators will lose.*

First of all, this is decentralized innovation that was not meant and created to be in centralized hands. So it won't work. I mean, look what happens when all of these exchanges, like FTX, and, you know, in the ones that are putting that into a centralized mechanism. Taking this decentralized technology and trying to put it into the centralized system, that's where the fraud comes.". The interviewee mentions this challenge from the perspective of the total power over Web 3.0 by the government by "centralizing the decentralization" which eventually is against the whole concept of Web 3.0 and which causes fraud to happen as happened with many exchanges and FTX being the biggest and the most recent case. Another way to look into this challenge can be seen from interviewee I-08. The interviewee's perspective is: *"I think that there are governance hurdles, obviously. We're experiencing that a lot, especially here in the US. You know, we have the SEC, which is the Securities and Exchange Commission here, which they believe that they are the ones to oversee this whole asset class, they are the ones to decide who can create stable coins, and they are the ones bothered with how DAOs work. In general, we see that there is a need for regulations, but currently, there are more bad regulations than good regulations, and it stops the technology from flourishing.".* The interviewee mentions a few aspects of how governmental regulations are trying to control and restrict certain aspects of Web 3.0, which consequently prevent the technology from being developed and improved but mention that there is a need for regulations. However, unfortunately, there are more preventive regulations for now than the ones that would help the technology. Governments heavily support traditional financial institutions, and the technology that will disrupt the financial landscape might only sometimes fit into existing regulatory frameworks. As a result, there is a disconnect between the pace of technological innovation in the Web 3.0 space and the adaptability of regulators to address the risks posed by decentralized finance, blockchain-based assets, and cryptocurrencies. There is a need to develop proper governance frameworks and laws that would eliminate these risks and complexities without stopping Web 3.0 technology from advancing and trying to force centralization into it.

Talking about regulations that would enable the growth of the technology and serve a good reason, we have the issue of money laundering in Web 3.0. Since the whole concept of Web 3.0 is built around decentralized blockchains, which means anonymity in the transactions, blockchains could easily become a ground for money laundering and other illegal transactions. For these reasons, **developing progressive Anti Money Laundering(AML) and Know Your Customer(KYC) frameworks within decentralized and pseudonymous systems poses challenges**. Interviewee I-09 says: *"Anonymity is great but at the same time it opens up huge problems like money laundering, like something like donating to illegal or even terrorist organizations or army, or even drug dealing. I don't know how common these cases are right now but I think it's obvious that we need to come up with some sort of regulations but currently, we do not know how".* The quotes of the interviewee emphasize the necessity of creating AML/KYC frameworks to prevent

fraudulent and dangerous activities in the Web 3.0 space; however, the quote ends with uncertainty about how it could be done. Overall, the interviews revealed that although there is a need for these regulations, it is not clear how they can be developed and what the starting point could be. Interviewee I-06 says, *"...when you think about bad sides and good sides. The good sides are that it's fast, very safe, and transparent. But bad sides are also coming with anonymous transactions like transactions for drug dealing or for other illegal things"*. As blockchain-based financial systems evolve, there is a growing urgency to bridge the gap between technological advancements and regulatory adaptation. The stakeholders in the Web 3.0 space try to collaborate with engineers and regulatory institutions to create modern regulatory solutions striving for a balance between innovation and regulation. By addressing these challenges, the blockchain community can demonstrate its commitment to building a transparent, secure, and compliant ecosystem that empowers individuals while upholding the financial system's integrity.

Finally, the last challenge under the category of regulations is **customer protection**. New technology means new opportunities for fraud, scams, and customer cyber attacks. When using a new technology, customers are vulnerable to fraudulent schemes, phishing attacks, or malicious smart contracts in the case of Web 3.0; *"...this is a new and complex technology, so this explains high fraud rates we got currently"* says I-10. Furthermore, usually in the financial world, there exist intermediaries that handle disputes in case of a wrong transaction or misoperation in general; however, in blockchain, a lot relies on smart contracts, and this can cause irreversible damage to customers. Interviewee TI-01 writes us: *"The technology is new, and the possibility of vulnerable smart contracts is there already. There is a need for a regulatory set of rules and actions to prevent fraud on both technical and logistic aspects of it. Currently, a lot depends on engineers writing the smart contracts and the customers of the Web 3 space."*. The interviewee notes that currently, the big responsibility is on engineers that develop smart contracts, whereas there is a need to review the whole system and develop a solution to minimize fraud rate to protect the customer of the Web 3.0 world. Addressing the regulatory challenges of Web 3.0 is crucial to provide a proper customer experience without stopping the technology from development and exposing customers to high risks related to the decentralized and anonymous nature of Web 3.0 technologies.

4.3.2 Technical challenges of Web 3.0 in the financial industry

Regarding the challenges related to Web 3.0 and the financial industry, we have a set of issues related to the technical aspects of Web 3.0. One of the most prominent challenges of Web 3.0 and blockchain technology is **scalability**. More than 80% of our interview participants mentioned scalability to be a technical challenge of Web 3.0. As Web 3.0's core technology is blockchain, which aims to accommodate a vast array of decentralized applications and services, the scalability of these blockchain networks becomes a critical consideration. Traditional blockchains, such as Bitcoin and Ethereum, have encountered

transaction throughput and confirmation times limitations. These bottlenecks can lead to slow and expensive transactions during periods of high demand, ruining the seamless user experience that Web 3.0 promises. Interviewee I-06 says: *"Blockchain is known to have scalability issues since first implementations of it came out. You know, every tech has its limitations and so does blockchain. In finance, scalability affects transaction speed and fees but there are currently works to eliminate that issue. Many different protocols try to solve the issues with scalability."*. The interviewee mentions that the issue of scalability is present, but there is ongoing development of certain protocols and solutions to address this issue. There have been efforts to eliminate this issue by introducing **layer 2 blockchain solutions**. These solutions aim to distribute and parallelize transaction processing, boosting the network's capacity to handle a larger volume of transactions without compromising security or decentralization. Introducing layer 2 solutions ultimately means reducing transaction costs, mining the security of these transactions, and possibilities for new use cases with better user experience. Blockchain community proposed layer 2 solutions to eliminate scalability issues of the layer 1 blockchain, and several projects already use this approach; however, these projects are still young and somewhat experimental.

Web 3.0 is an emerging concept that utilizes new technologies and tools; however, more than half of the interviewees mentioned that there is a **lack of technical tools** that would allow the development of complex and high-performance solutions. As Web 3.0 technologies emerge, new services and DApps are being created using certain programming languages and tools. Interviewees with a technical background or who actively participate in Web 3.0 product development mentioned and confirmed that there is a lack of libraries, frameworks, and general tools to effectively create complex decentralized applications. Interviewee I-05 mentions: *"One of the hurdles is definitely lack of tools, specifically automation tools. I think we need more people to get into this, create more open-source tools that can be used in creating Web 3 applications."*. The interviewee mentions the challenge of the absence of tools, specifically focusing on automation tools, and claims that we need more people to start open-source projects to elevate this issue. In contrast, other interviewees (I-10) mentioned the small size of the Web 3.0 engineering community making it harder to find solutions to certain bugs and issues; *"...and the community of engineers is small which makes it harder to look for solutions and knowledge exchange"*. With time we will see more and more engineers come to the development of decentralized applications creating open-source products, and possibly companies getting into developing their tools and frameworks.

The next challenge is **UI/UX problems**, closely related to the previous challenge of lack of technical tools. Currently, the user interface of the financial applications in Web 3.0 is more technical and comprehensible for people with experience and knowledge of blockchain. Tokens, keys, wallets, and things like this are hard to understand for many people that use the Internet nowadays. Interviewee I-10 says: *"Right now UX is lacking,*

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which stops many people from using DeFi and blockchain. It is understandable for more tech-savvy people, but regular people like, you know, our parents struggle to even use their bank app". The interviewee mentions that DeFi and blockchain applications have complex UI/UX, which stops many people from using them. Older people are not fully capable of using mobile banking yet, and here we are introducing DeFi applications with even more complex functionalities and features. Another interviewee (I-04)talks about this issue; *"... you want to have the user using Blockchain technology, without even knowing they're using blockchain technology. With various protocols that we look at, have you heard about account abstraction? When it comes to theory, I think it's EIP-4337, something like that, where that's exactly what they're doing. There are different key recovery methods, different ways... it's just a whole different user interface on how these wallets interact with protocols. And that's the key to mass adoption, because even though maybe to you and me, taking a couple of extra steps to get into Web 3 and DeFi is not a big deal. It's a big deal for the average user. It's a big deal for maybe the old American that's not tech-savvy. So I think that the main challenge is just making it super easy, where people don't even know they're using Blockchain. And then we'll be able to achieve mass adoption".* What the interviewee talks about when mentioning the term **account abstraction** is the proposal to increase flexibility in the management and behavior of Ethereum blockchain accounts. The concept of account contracts is being introduced, which are special-purpose smart contracts that define and manage a user's Ethereum account. By doing that, users can access their funds using a smart contract wallet instead of relying solely on private keys for security. This is possible because smart accounts can have custom rules for spending coins and transferring assets. Inherently, account abstraction removes most of the friction associated with using Web 3.0 and DApps, which brings Web 3.0 to the ideal of Web 2.0, where all users—both novice and experienced—can benefit from the same degree of flexibility, security, and ease of use [30]. Solving UI/UX issues with the Web 3.0 and DApps will bring more users to the space boosting the speed of the improvements of the technology.

The last challenge related to technical ones is the **absence of credit score frameworks** for DeFi platforms. In traditional finance, the credit score is a numerical representation of someone's creditworthiness. It is calculated based on various factors like payment history, length of credit history, types of credit, etc. Web 3.0's DeFi allows people to perform lending and borrowing operations; then, the question arises of how creditworthiness should calculate for DeFi if everything is anonymous. Interviewee I-07 says: *"The issue with the credit scoring in DeFi is only one leg of the stool or the table. In traditional finance, you're checking someone's you know, past credit card usage, you're checking to see if there was any, you know, report in the Federal Trade Bureau against them. Or if they're bankrupt, when defi, you would just check their past on-chain transaction, but you're not able to see how they pay their bills. So there are companies that are working to bridge the gap. And there are already things like spectral finance,*

which gives you a credit score based on your activities, and decentralized finance. It's just in beta mode. But based on how many loans I've taken, or you know, how many assets I have in my wallet, and how quickly I paid back my loans, they'll give me a score so that in the future apps can target me for new products.". The interviewee mentioned a company named "Spectral Finance" (`https://www.spectral.finance/`), which is a company aiming to create a reputation system for blockchain wallets that can be used in decentralized finance. As for now, there is not much available information about it; however, reading through their blog, it is understandable that they use a variety of metrics to generate a scoring system, those metrics being the number and volume of the following transaction types, including various time-based related metrics: borrowing, repayment, deposit/Lending, redemptions, liquidations credit mix — diversity of interactions with various DeFi protocols, wallet transactions, including wallet balance, account health-related indicators, e.g., the amount borrowed as a proportion of the available collateral [44]. Another interviewee I-04 talks about this challenge from a different perspective: *"I think this is where DeFi and traditional banks can collaborate and come up with a joint solution. Maybe we can utilize credit scores in DeFi by taking this data from the banks that are willing to integrate into the DeFi world. It's all my speculations but I see the possibility in that".* The interviewee says that this area of DeFi could be where collaboration with traditional financial institutions is possible. To conclude, the absence of credit score frameworks in DeFi presents a challenge. However, developing reliable credit scoring mechanisms within DeFi or collaborations between DeFi and traditional finance institutions offer promising avenues to address this issue and bridge the gap between the two ecosystems.

4.3.3 Adoption challenges of Web 3.0 in the financial industry

During the interviews, adoption challenges were the ones that came into conversation first and were extensively discussed by the interviewees. The main and the most mentioned challenge of Web 3.0 related to adoption was **lack of education** about it. There is not enough educational content that would introduce regular internet users to the concepts of blockchain, DeFi, and other Web 3.0 components. Interviewee I-10 addresses this issue as so: *"I think education is definitely is, you know, a hurdle that we have to get over because a lot of this is so new to people and it's scary. I also think that you know, people are very comfortable in the traditional banking system, they feel safe, you know. Actually, it's interesting because now that we're seeing bank runs here in the US, and some of these bank collapses and failures, people aren't going to feel so safe anymore. And they'll probably even gravitate towards decentralization because now they may say, okay, you know what, I was scared of decentralization and blockchains but I am also scared to lose my money, so maybe I should give a DeFi a try.".* The interviewee emphasizes that the lack of education on the technology causes people to feel unsafe using it, so fewer people use it. However, the interviewee speculates that the vulnerability of traditional financial

institutions might affect people's mindset toward Web 3.0 financial solutions like DeFi, and people might slowly transition into using them. Users who lack knowledge of details of the decentralized ecosystem might expose themselves to vulnerabilities, falling prey to cyberattacks or scams.

Another interviewee, I-08, talks about the education problems from his perspective: *"...there are enough good actors creating value in Web 3, but we hope we can continue to educate the masses or anyone who's new so that they don't get scammed continuously. It's almost inevitable for you to get scammed. In crypto, or Web 3, in one way or another, just like a normal life where you get scammed or taken advantage of you learn, you move forward, and you do things differently. Yeah. So education is such a big problem, because most people, even my mom, who has been working in this industry still thinks, you know, whatever the news tells her is probably the best source. So education of the people is a big problem, in addition to the regulation, and others we know."*. The interviewee mentions that the lack of education on the technology causes people to get scammed when using blockchain technologies which is a natural thing that happens day to day with regular ways of financial interactions between people. Moreover, the absence of education also hinders the creation of a well-functioning ecosystem and the development of technology. Skilled developers and entrepreneurs are crucial for the growth of any technology, and without a proper understanding of the principles of Web 3.0, creators of the space might struggle to create groundbreaking applications that could reshape industries. To address this issue, educational initiatives must be established; courses at institutions, workshops, webinars, and various seminars could be crucial in disseminating information to a broader audience. Additionally, collaborating with stakeholders, governments, and technology enthusiasts could affect the spread of information. Finally, by addressing education issues with Web 3.0, we could potentially speed up the growth of the technology, but also, we could reduce the rates of fraud and scams, leading to a more significant user base.

Finally, the last challenge from the category of adoptions and the last overall mentioned by our interviewees is the **resistance from traditional financial institutions**. The idea behind it is that experts in the industry find that traditional financial institutions refuse to collaborate with Web 3.0 service providers and sometimes even promote information about fraudulent and unstable activities in Web 3.0. Interviewee I-10 says: *"...banks and other traditional financial institutions feel the pressure you know. They for once got a competitor and they don't know what to do now. But you know, they understand that they will lose this competition that's why it's smarter for them to collaborate and some are already doing that."*. The interviewee mentions that traditional financial institutions mostly see Web 3.0 financial services as competitors, which makes sense with all the benefits that blockchain brings to the table; however, a collaboration of traditional financial institutions and emerging Web 3.0 financial institutions would help to create a powerful financial institution where both parties could benefit. The

traditional institutions operate within centralized frameworks, where control, authority, and decision-making are concentrated in the hands of a select few. Having enough power and reputation among people and seeing a decentralized and more democratic Web 3.0 system as a threat, there can potentially arise skepticism and resistance towards Web 3.0. As previously mentioned, the decentralized nature of Web 3.0 requires creating new regulatory frameworks, which might not be as suitable for traditional institutions for the reasons mentioned above. Furthermore, *"...traditional institutes invested too much in their current infrastructure."* (I-02), which makes it difficult to justify the transition to new and unfamiliar technology, followed up by the high risks and costs of this transition. It is essential to mention that our interviewees strongly believe that there should be the collaboration of Web 3.0 technology and traditional institutions where both parties will benefit, or the natural flow will lead to Web 3.0 technology eventually replacing traditional financial institutions leading to massive disruptions and transformations in the global financial landscape.

5 Discussion

This thesis section discusses the results and presents a framework correlating use cases, their values, and challenges.

The first research question of this thesis is: "What are the potential use cases of Web 3.0 in the financial industry?". The results show that the use cases could be grouped under four categories: DeFi, payments, tokenization, and 3D.

The DeFi category showed us three solid use cases; lending and borrowing, ReFi, and commodities market. In DeFi lending and borrowing, lenders deposit their cryptocurrency into smart contracts provided by the platform owners, and borrowers can request loans by offering collateral. The essence of the ReFi use case is rooted in the collaboration of Web 3.0 technologies and efforts to create an environmentally conscious and sustainable financial ecosystem. The commodities market is the use case representing opportunities for commodities trading operations within DeFi platforms. The payments category presented us with two use cases; remittance and round-up savings. Remittance use case refers to the ability to perform cross-border transactions using Web 3.0 technologies such as blockchain and DApps. The use case of round-up savings involves the creation of DApps that could automatically use round-ups from individuals' daily purchases and accumulate cryptocurrencies with them, creating opportunities for passive income. From the tokenization use cases, three primary use cases were identified; physical asset tokenization, fractional ownership, and user data tokenization. The use case of physical tokenization represents the ability to create virtual tokens representing physical assets, further allowing their trading. Similarly, fractional ownership represents the possibility of partial ownership of an asset by owning a certain amount of a token representing the fraction of an asset. The use case of storing user information as blockchain tokens is technical and represents the concept of tokenizing user information, thus giving full ownership of it to the user. Finally, the last category of 3D presented us with the use case of creating virtual bank spaces using Web 3.0 technologies. The use case aims to utilize AR and blockchain technology in the context of Web 3.0 to create virtual bank spaces where users could interact with the institutions in a more immersive way.

Some DeFi-related use cases were mentioned in the literature, for example, lending and borrowing [8] [45], and as expected, it was mentioned by every interviewee. The lending and borrowing use case of DeFi is one of the most mature and stable right now because it is one of the core concepts of Web 3.0 and the financial industry, and much effort has been made to make it possible. The use case of the commodities market is the extension of the lending and borrowing use case, but it was not mentioned in the literature. The reason for that could be that this use case exhibits a marked specificity and is of lesser scope than regular lending and borrowing operations. The flow from traditional lending and borrowing operations to being able to trade commodities seems natural. Similarly, ReFi is the use case not found in the literature but was mentioned by

almost half of the interviewees. After discovering ReFi and performing a search, we discovered a few blog posts with information about it; however, the number of relevant search results was limited and mainly consisted of the websites of the ReFi project themselves. Such scarcity of information about ReFi might be because it is a young and just recently introduced concept, aging for about a year or two. Despite being a new use case, ReFi has a vast potential to disrupt how sustainability and preservation of the environment are handled nowadays by introducing blockchain and other Web 3.0 components. Regarding payment-related use cases, the use case of remittance was mentioned in the existing literature [39] [46] and, as expected, was heavily supported by most interviewees. However, the use case of round-up savings was not found in the reviewed literature despite being mentioned by the interviewees. Worth mentioning that the use case of round-up savings, similar to commodities markets, represents a more minor use case that could become a prominent aspect of Web 3.0's financial landscape over time. The literature partially mentioned the use cases of the tokenization category; physical asset ownership was found to be one of the primary use cases with the potential to disrupt the traditional financial industry [54] [36]. However, the reviewed literature did not cover fractional ownership of assets and storing user data as blockchain tokens. Several interviewees supported the physical asset ownership use case and fractional ownership of the assets, which indicates their importance for the financial industry within Web 3.0. In contrast, storing user data as blockchain tokens was only briefly mentioned by a minority of interviewees, which the technicality of the use case could explain. The use case of virtual bank space from the category of 3D was addressed in the literature [22] and similarly was mentioned by some interviewees. Noteworthy, one of the interviewees (I-05) expressed his doubts about this use case's need.

Our observations have led to the identification of significant patterns and trends. The diverse range of use cases falls into three categories: introducing novel processes, enhancing existing ones, and embedding them in the existing infrastructure. For instance, ReFi's integration of blockchain technology to facilitate environmentally conscious financial transactions is an entirely new idea enabled by Web 3.0. The Web 3.0 components create another new opportunity within the financial industry by utilizing physical asset tokenization and fractional ownership, bringing the potential for simple ownership and trading. Real estate and other high-value assets are now available for stakeholder ownership in fractional amounts, democratizing formerly exclusive investment opportunities for those in wealth. These use cases are only possible due to the various Web 3.0 components and their combination. In contrast, DeFi's lending and borrowing use case, commodities market, and payments-related use cases are the results of leveraging Web 3.0 technology to enhance the respectful traditional financial use cases but bringing the transparency and efficiency offered by blockchain technology. Listed use cases benefit from Web 3.0 technology, but it comes with various regulatory, technical, and adoption challenges. Additionally, some use cases can be viewed as seamlessly embedded within established

technologies. For example, use cases of virtual bank spaces and round-up savings aim to integrate new financial applications into the existing financial landscape seamlessly.

The second research was presented as "What value does Web 3.0 bring to the financial industry and its customers?" and was focused on the values that Web 3.0 and its use cases in the financial industry bring to people and institutions.

During the interviews, we realized that Web 3.0 values can be divided into four categories; security, efficiency, accessibility, and incentives. From the security values, we see transparency, reduced reliance on intermediaries, and user asset ownership being the main ones. Followed up with anonymity and reduced risk of fraud and cyber-attacks. Efficiency values such as faster transactions and lower transaction fees are the central two values of the category, with automation and AI assistance being the other two essential values. A more portable and democratic financial system are the values that belong to the accessibility category. Finally, the incentives category is prominent for two new value ideas; watch to earn and participate to earn.

Every use case brings a set of benefits for the financial industry participants. Almost every use case brings transparency and reduced reliance on intermediaries, the two main benefits of using Web 3.0 in the financial industry. However, use cases such as round-up savings and virtual bank spaces do not prioritize transparency as the principal value, and similarly, round-up savings use case does not have intermediaries as the primary value variable. Looking at the reviewed literature, we see that efficiency benefits were heavily mentioned [9] [51], explaining the fact the interviewees supported them. The use cases originating from the traditional financial sector and adopting the attributes of Web 3.0 benefit from cost reduction and faster transactions that Web 3.0 technology brings. Nonetheless, use cases within the tokenization domain underscore security considerations, such as asset ownership and transparency as paramount, shifting emphasis from efficiency values. Accessibility values of Web 3.0 were not mentioned in the literature but were mentioned by the number of interviews. Almost every use case brings the benefits of portability of the traditional financial system and democratization of the financial system. Allowing anyone to participate in the financial system is enabled by the decentralization of Web 3.0, which eventually brings more stakeholders to the industry. Banking the unbanked people without the need for intermediaries is also a way for new participants in the industry to occur. The only use case that does not bring these benefits is storing user assets and information as blockchain tokens; however, this is explained by the more technical benefits and the use case being the main enabling use case for creating incentivization values such as watch to earn and participate to earn. These benefits were not mentioned in the reviewed literature, and noteworthy that they did not have considerable popularity during the interviews. However, several interviewees believed that these benefits could be realized with the proper use cases being implemented.

The last research question of this research was stated as "What are the challenges related to Web 3.0 within the financial industry?" and was aimed to explore the challenges

faced in Web 3.0 and the financial industry. During the data analysis process, we identified three major categories of challenges; regulatory, technical, and adoption.

Regulatory challenges consist of three major points; central governance, AML/KYC framework absence, and lack of customer protection mechanisms. The issue of central governance indicates the problem of centralization of Web 3.0 solutions, which inherently does not fit into blockchain's core principles. The absence of AML and KYC frameworks indicates gaps in the regulations caused by the anonymity of blockchain transactions, making it hard to detect the purpose of the transaction. The lack of customer protection mechanisms is the issue resulting from the decentralized nature of Web 3.0. The absence of central authority participating in decision-making and conflict resolution requires the creation of new mechanisms. The most prominent technical challenge is scalability, a known blockchain technology issue. UI/UX is the issue bringing up complicated interfaces of Web 3.0 applications that require users to know various blockchain terms. The lack of tools is a challenge caused by the small number of tech libraries, frameworks, and other development components within Web 3.0. Finally, the absence of credit score frameworks is a crucial issue within DeFi solutions, underlining that currently, there are no ways to detect if a person is worthy of participating in the system or if the user is malicious. The challenges related to adopting Web 3.0 technology cover a lack of education and resistance from traditional financial institutions. The first indicates insufficient educational sources to learn about blockchain technology and Web 3.0, and the latter is the resistance traditional financial institutions show to adopt a new technology or collaborate.

The reviewed literature mentions the fraud issue within Web 3.0, which closely correlates with customer protection challenges mentioned by our interviewees. The fact of no intermediaries within blockchain services, in combination with the novelty of the technology, leads to high fraud rates and the absence of their resolution methods. Central governance and AML/KYC frameworks are other significant regulatory challenges. The efforts to force central authority into a decentralized infrastructure do not fit blockchain fundamental principles, as the technology is designed to operate without single points of authority and to distribute decision-making power among network participants. Almost all use cases requiring fund transactions face this issue, except for virtual banking environments and round-up saves, where the issue is less critical. The issue with the absence of the AML/KYC frameworks creates an environment conducive to the influx of illegal funds via blockchain channels, and the anonymous nature of the blockchain mainly enables it. This exacerbates current regulatory difficulties and goes against the primary goal of fostering transparent and accountable financial ecosystems. Similarly to central governance, the issue of the absence of AML/KYC frameworks affects almost every use case except those where it is not as crucial. Technical challenges within Web 3.0 services are extensively represented in our interviewees. The issue of scalability is a knows mentioned issue that was also mentioned in the literature [9]. The pattern

is similar to before; the use cases that include fund transactions face this challenge as scalability issues reduce transaction speeds, whereas use cases like round-up savings, tokenization of user data, and virtual bank spaces are not mainly affected by it. However, the challenges with UI/UX and the lack of tools in Web 3.0 DApps are present within every use case identified. Finally, the technical challenge of the absence of credit score frameworks relates only to the use case of DeFi lending and borrowing as it is in traditional financial institutions. The lack of education related to adoption challenges within Web 3.0 is represented by every use case since the education on Web 3.0 overall is lacking. However, resistance from the traditional institutions was mentioned within all DeFi and tokenization use cases. In contrast, virtual bank spaces and round-up savings do not have this challenge since these use cases could be a ground for collaborations of traditional institutions with Web 3.0 technology.

To present the thesis results and give the overview, the findings are put into a framework presented below in Table 5. The framework presents the use cases of Web 3.0 in the financial industry, their value, and their potential challenges.

5.1 Limitations

There are certain limitations to this thesis that need to be addressed. To begin with, the small number of interview participants may not present as detailed an overview as expected. The concept of Web 3.0 is complex and has various realizations. Although we tried to gather interview participants with various backgrounds and projects they are working on, overall, their opinions were pretty similar. This trend could be different if the number of participants was more significant. In addition to the number of participants, their experience with the technology is also essential. Web 3.0 is a relatively new concept with few related projects, and it is tough to find people with more than two years of experience in this area.

Another possible limitation could be the misinterpretation of the questions. Qualitative survey methodology, precisely interview style, allows us to have back-and-forth conversations and ask questions if anything is unclear; however, several interviewees mentioned that the questions asked are significant and precise.

Moreover, another possible limitation is related to the methodology. Having only one person performing interviews, transcribing them, and performing thematic analysis could lead to the human factor error of misinterpretation of the answers given by the interviewees.

Finally, it is crucial to understand that with such a new and emerging technology like Web 3.0, it takes much work to find the correct information, experts in the field and to catch all the potential use cases of the technology, considering that every month the landscape of the technology changes. In addition, several interviewees could only talk about the technology broadly without going into details for the reasons of confidentiality or signed NDAs. Finally, it is always worth considering the possibility of bias from the

Category	Use Case	Values	Challenges	Description
DeFi	Lending and borrowing	Transparency; reduced reliance on intermediaries; asset ownership; anonymity; reduced fraud; faster transactions; lower fees; automation; AI assistance; portability; democratization of the financial system	Central governance; AML/KYC frameworks; Customer protection; Scalability; Lack of tools; UI/UX; Absence of credit score framework; Lack of education; Resistance from traditional institutions	Lending and borrowing operations in blockchain are similar to those performed in traditional finance; however, Web 3.0 speeds up the process, reduces fees, and creates a transparent environment without intermediaries. There are many challenges with this use case, and the main ones relate to regulations.
	ReFi	Transparency; reduced reliance on intermediaries; automation; portability; democratization of the financial system	Central governance; AML/KYC frameworks; scalability; Lack of tools; UI/UX; Lack of education; Resistance from traditional institutions	ReFi uses blockchain and cryptocurrencies to allow reinvesting in communities that regenerate natural resources and promote equitable wealth distribution to create lasting and regenerative impact. It brings transparency to these operations and allows anyone to participate in this ecosystem. The main issue of it is the lack of education on the use case.
	Commodities	Transparency; reduced reliance on intermediaries; asset ownership; anonymity; reduced fraud; faster transactions; lower transaction fees; automation; AI assistance; portability; democratization of the financial system	Central governance; AML/KYC frameworks; Customer protection; Scalability; Lack of tools; UI/UX; Lack of education; Resistance from traditional institutions	Blockchain commodities is a use case where tokenized commodities can be traded on the blockchain, bringing self-sovereignty and income opportunities. The main challenge of it is lack of education and regulatory challenges.
Payments	Remittance	Transparency; reduced reliance on intermediaries; asset ownership; anonymity; reduced fraud; faster transactions; lower transaction fees; automation; AI assistance; portability; democratization of the financial system	Central governance; AML/KYC frameworks; Customer protection; Scalability; Lack of tools; UI/UX; Lack of education; Resistance from traditional institutions	Remittance leverages Web 3.0 blockchain technologies to make cross-border transactions faster, cheaper, and more transparent. The main challenges relate to AML/KYC frameworks and other regulatory issues. Also, technical challenges are critical to be solved for this use case.
	Round-up savings	Automation; AI assistance; portability; democratization of the financial system	UI/UX; Lack of tools; Lack of education;	Round-up savings is a use case that utilizes the principles of automatic spare change accumulation with cryptocurrencies, rounding up everyday transactions to invest small amounts in digital assets. No obvious challenges with this use case besides not enough information about it, which is a result of bad education, and UI/UX issues are on the way.
Tokenization	Physical asset tokenization	Transparency; reduced reliance on intermediaries; asset ownership; anonymity; automation; portability; democratization of the financial system	Central governance; AML/KYC frameworks; Customer protection; Scalability; Lack of tools; UI/UX; Lack of education; Resistance from traditional institutions	Asset tokenization in Web 3.0 allows trading physical assets on various marketplaces. Web 3.0 and tokenization are the main enablers for this use case, bringing transparency, reduced fees, and access to global markets. The main issues with this use case relate to regulations.
	Fractional ownership	Transparency; reduced reliance on intermediaries; asset ownership; anonymity; automation; portability; democratization of the financial system	Central governance; AML/KYC frameworks; Customer protection; Scalability; Lack of tools; UI/UX; Lack of education; Resistance from traditional institutions	As an extension to physical asset ownership, fractional ownership allows those physical assets to be fractional, creating a more democratic financial system allowing everyone to participate.
	Storing user assets and info	Transparency; asset ownership; anonymity; watch-to-earn; participate-to-earn	Central governance, scalability; Lack of tools; UI/UX; Lack of education; Resistance from traditional institutions	Storing user assets and info as tokens is a technical use case that enables data ownership; users share their private data only if they wish to. This could potentially create a watch to earn and participate to earn concepts that would be beneficial for customers and organizations.
3D	Virtual bank spaces	Reduced reliance on intermediaries; automation; AI assistance; portability;	Scalability; Lack of tools; UI/UX; Lack of education;	Many organizations, including traditional financial institutions, would like to experiment with using VR/AR technologies to create virtual bank spaces, reducing the need for physical offices, and leading to reduced operational costs.

Table 5. Overview of the Use Cases, Values, and Challenges.

interviewees.

6   Conclusion

This thesis aims to understand how Web 3.0 could create financial use cases, what their values are, and which challenges can occur. To address our research questions, we've chosen the qualitative survey methodology, conducting interviews with experts in the field to get their perspectives on these questions. Further, we analyzed the interviews, performed thematic coding, discussed them, and presented results in a framework.

To summarize, the research revealed four main categories of use cases of Web 3.0 in the financial industry; DeFi, payments, tokenization, and 3D. The main use cases from the category of DeFi are lending and borrowing, ReFi, and the commodities market. From the category of payments, the main use case is remittance, followed up by the smaller use case of round-up savings. Prominent tokenization use cases are physical asset tokenization and their fractional ownership, and a more technical use case is storing user assets and information as tokens. Finally, creating virtual bank space is the only use case from the category of 3D.

Similar to the use cases, the values of Web 3.0 for the financial industry could be grouped into four categories. Security values are notable with transparency, reduced reliance on intermediaries, and anonymity. The category of efficiency gives us two crucial benefits; faster transactions and reduced transaction fees, followed by the possibilities for automation and integration with AI. Accessibility use cases reflect the portability of the financial system and the creation of a more democratic financial system. The last category of incentives reveals two new concepts of the watch to earn and participate to earn, which are enabled by Web 3.0 and its decentralized approach.

Finally, the challenges of Web 3.0 within the financial industry were grouped into three categories. The majority of the interview participants mentioned regulatory challenges, noting the need to create AML/KYC frameworks as well as customer protection mechanisms, but the issue of trying to force central authority over the blockchain applications was also emphasized. Technical challenges of Web 3.0 were also mentioned during the interviews, mentioning the scalability issues of Web 3.0. lack of technical tools, too complex UI/UX, and the absence of credit score mechanisms in DeFi. At last, the interviewees mentioned adoption issues with blockchain technology, bringing up the lack of education about the technology and the resistance from traditional institutions that hinders the growth of the technology.

The thesis contributes with a framework that emphasizes the correlation between the use cases and the values they created and the challenges related to the use cases. The framework is expected to be essential and valuable for: specialists working in the R&D departments of financial institutions, startups planning to leverage Web 3.0 technology to create innovative solutions, policymakers that create regulations that shape the financial industry landscape, and researchers that want to dive deeper into the relationship between innovative technology and the financial industry.

As for future work, broader research with more participants could be conducted, catching more use cases and other variables about Web 3.0 and the financial industry. Also, certain issues mentioned in the framework could be resolved by proposing a regulatory framework or a technical tool that would help to tackle some technical issues with blockchain technology. Finally, creating more information sources to deal with the issue of bad education could be one of the strategies for future work.

6.1 Recommendations for Further Studies

We noticed a need for further studies in certain aspects resulting from the conducted study. Many interviewees did not mention the use case of ReFi; however, the idea behind it is extremely promising. Conducting interviews with people working on ReFi projects could potentially shed more light on this use case and be helpful.

In addition, the interviews show that the regulatory challenges related to Web 3.0 are a big problem nowadays. As mentioned by the interviewees, for now, it's not certainly clear how Web 3.0 technology can be regulated without slowing down the progress of the technology, so any research proposing a regulatory solution such as AML/KYC frameworks or credit score framework for DeFi could help the technology to grow.

To address technical challenges related to Web 3.0, certain tools could be developed to make automation, UI/UX, and integration of AI in blockchain easier. Engineers and companies working in the field could contribute to the existing open-source projects or initiate new ones contributing to the overall growth of the technology.

Finally, the issue of the lack of education about Web 3.0 and blockchain is an issue that needs to be handled urgently. Educational institutions, various stakeholders, and industry participants could create courses, workshops, and other educational channels to teach people how blockchain works and what Web 3.0 as a concept is. Doing this will raise interest in the technology and reduce the fraud and scam rates in the decentralized finance platforms currently.

Acknowledgments

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7 Appendices

7.1 Appendix 1 - Survey

Questionnaire

1. General Questions

   - What are your current position and responsibilities?
   - How many years of experience do you have in Web 3.0 and the financial industry?

2. Requirements Questions

   (a) Use Cases Related Questions (RQ1).

      - What use cases of Web 3.0 do you see being developed in the financial industry?
      - Which services, products, and processes can be affected by Web 3.0 in the financial sector?
      - Existing work and literature mentions _ as a use case for Web 3.0 in the financial sector. What is your opinion on it?

   (b) The value of Web 3.0 Related Questions (RQ2).

      - How developing Web 3.0 solutions within financial industries will bring value to organizations?
      - How developing Web 3.0 solutions within financial industries will bring value to the customers?
      - Existing work and literature mentions _ as a value brought by Web 3.0 to the financial sector. What is your opinion on it?

   (c) Challenges Related Questions (RQ3).

      - What do you think are the challenges related to Web 3.0 within the industry?
      - What do you think are the time frames for the financial industry to develop and change solutions and services around Web 3.0?
      - What do you think is necessary before financial solutions can be integrated into Web 3.0?
      - Existing work and literature mentions _ as a challenge related to Web 3.0 and the financial sector. What is your opinion on it?

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