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Chapter one: Introduction
The Opportunity

Introduction

Real Estate is historically considered one of the safest investments and people in all times have tried to get a piece of land to secure their and their heirs future. For centuries, it has symbolized power and wealth and for this reason, humans have tried to colonize new lands all over the planet. However, now pretty much the whole planet is lived by people who own the surrounding properties and therefore the new challenge would be to colonize the moon or any other livable planet by the humankind. But let's be honest: there is still a long journey before we cross that frontier. In the meanwhile, why don't we try to maximize the utility that comes from the already known properties? Well, this is our idea. As lands are finite and the demand is increasing by each day, we believe prices will always go up so investing in this sector will surely be very profitable in both the short and long term. But there is a big problem. If prices go up, lower and middle class families would be cut out and will not be able to enter easily into this market and so this would remain a business for only a restricted circle of wealthy parties. What we offer is a solution to this important issue.

In this report, we propose **XTerra,** a new platform for real estate tokenization which will provide investors with a simple, intelligent and user-friendly method to purchase fractional, tokenized properties without the need of intermediaries. Our mission is to **democratize access to real estate** and minimize the risks and labor involved with owning property. By investing in asset tokens issued by XTerra, customers will have access to quarterly and annual reporting like cash flows and maintenance reports related to the property (e.g., rent) and the frictionless ownership transactions via the blockchain. The service will be available initially in Switzerland which has the perfect environment for the idea realizations as it has already established an appropriate legal framework for digital assets ownership. However, we plan to further expand our coverage to other states as soon as the technology will permit.

A new wave in real estate

In the summer of 2020, one of the largest cryptocurrency trading platforms tZERO began trading a security token that represented fractional ownership of a luxury resort in Colorado. It has also partnered with real estate crowdfunding firm NYCED Group to **tokenize $18 million worth of properties**. In the September of the same year, RealX, a financial technology company based in Pune, India, launched a blockchain-based ledger system to enable fractional ownership in the country. RealT, a US company offering tokenized property ownership has successfully tokenized 75 properties since 2019.

These are just a few examples of an emerging trend in the real estate industry: the sale of fractioned assets. Although for now it is still in its infancy and remains a niche aspect of the market, experts say there is a massive growth potential. UK accounting network Moore Global estimates that the tokenized real estate market could reach a **valuation of $1.4 trillion** (0.5% of the current global real estate market) by 2026 thanks to tokenization. With a total asset value of **$228 trillion globally**, real estate is a more valuable asset class than bonds and stocks combined, which makes it one of the most **attractive and promising** use cases of blockchain technology.

Tokenization is the process of representing fractional ownership interest in an asset with a blockchain-based token. In general, tokens may represent not only ownership of an asset, but also an interest in the legal entity that manages the asset, an interest in the debt secured by the asset,

the right to participate in the income or profits generated by the asset, and many more things. Unlike the recent boom of non-fungible tokens (NFTs) in digital art, in the context of real estate tokens, values are tied to the physical assets they represent. Similarly to traditional real estate investment, the types of properties that can be tokenized vary from **residential or commercial real estate to industrial or retail space**.

For tokens to be economically valuable they should be legally recognized. Currently only a few European countries have approved of digital assets ownership and allowed for fractionalization through tokenization. In February 2019, the Luxembourg parliament passed a bill to give **legal status to securities issued on the blockchain**, opening up opportunities for the tokenization market.[1] A year later new blockchain laws came into force in Liechtenstein.[2] Based on these laws, companies and entrepreneurs now can tokenize any right and therefore also any asset in a straightforward way. In February 2021 Switzerland updated the law allowing for tokenized securities to be traded on a blockchain with the same legal standing as traditional assets, thereby opening the door for asset tokenization in one of the most attractive and stable real estate markets in the world. Among these three early adopters we choose to start with Switzerland since it offers a larger real estate market and therefore potentially higher demand for our service.

A case for real estate tokenization

Fractionalization and tokenization of real estate has been a hot topic for a few years now, even though the concept of fractional ownership is not new. One popular alternative in the legacy market is the wide assortment of Real Estate Investment Trusts (REITs). REITs own income-producing real estate and share a portion of the income with their investors. Despite an attractive diversification opportunity that they provide, REITs are notorious for their high fees and commissions. Besides, transactions may take up to a couple of weeks if an investor decides to invest or divest in a certain property.

A few initiatives have been taken to overcome the shortcomings of REITs. The launch of The Property Stock Exchange (IPSX) in London is an example of a proposal to that circumnavigates the issues coming with trusts investments. There are also some more radical propositions to split ownership via digital tokens, by employing the distributed ledger technology to register ownership and track trades. As expected, so far The United States are the leaders by number of

[1] https://www.funds-europe.com/luxembourg-report-2020/digital-assets-the-call-for-clarity

[2] https://philippsandner.medium.com/liechtenstein-blockchain-act-how-can-nearly-any-right-and-therefore-any-asset-be-tokenized-based-389fc9f039b1

successful projects in this innovative area, but other regions are also catching up.

In 2019, for the first time ever, a **property was sold via a blockchain transaction for €6.5 million in France**. The transaction took place in three steps. Initially, ownership of the building was transferred to a corporation called "SAPEB AnnA". The company's ownership was then split into 10 Ethereum powered tokens and distributed to the new owners. In the final step, each of these tokens was further divided into 100,000 units, and the face value of each token was €6.50. The tokens were bought by French real estate companies Sapeb Immobilier and Valorcim.

A closer look into the past use-cases and existing projects in digital assets ownership has revealed us a potential gap in the market which we can fill. There is an evident lack of accessible and convenient investment tools for **small and medium retail investors** willing to enter the real estate market. As stated previously, traditional investment instruments, e.g. REITs and direct purchases, have a number of drawbacks which can be solved through the use of a blockchain.

One of the most significant issues with investing and selling real estate is the liquidity of the asset. In the normal course of a transaction, there are **many different parties involved**, especially with the legal transfer of the asset. Depending on the country, the process might take up to several months, and it might be needed to be anticipate additional costs arising from notary and other legal services. Tokenization could potentially mitigate this issue in specific situations allowing ownership to be transferred directly from investor to investor and thus offering a high level of operational efficiency by reducing transaction costs.

The use of a blockchain can also mitigate any issue arising from **multiple ownership claims** because, as it is public, the network would show the rightful owner of the underlying asset.

Traditionally, real estate investment requires a **capital lock-in** for an extended period of time. Tokenization enables greater liquidity both for property owners willing to sell their assets and for investors who might want to exchange tokens or withdraw their investment. The liquidity in the secondary market will depend obviously on the level of demand for the assets and the adoption of a suitable technology and legal framework.

We should keep in mind though that the audience we want to target, at least initially, is mainly formed by people who have already been exposed to blockchain technologies or ‘early adopters’ – technology-friendly people willing to try out a new investment opportunity. With the coming introduction of Central Bank Digital Currency (CBDC) we expect to expand our target audience to include more retail investors which are currently hesitant and not necessarily tech friendly.

Until now, we have focused on the benefits that the use of a blockchain for real estate tokenization would bring to the buyer's side. However, property sellers will also be able to benefit from this technology. Indeed, **higher selling prices** might be achieved, and quicker sales might take place. Since tokenization dilutes a bit an asset's value and gives more possibilities to the low-income customer segment to enter the market, investors willing to buy a token become less sensitive to price changes. Hence, the final sale price of a property will be dependent on the real value of the underlying asset and the demand for the issued tokens. Trading the real estate tokens in a stock-like market can raise some concerns about the increasing discrepancy between the value of a token and the real value of the property. In order to avoid so, some clear decisions must be made. One way to preserve the fair value of a token is to introduce pricing boundaries which will limit the assets value to give space to speculation and can be determined through an AI-powered price prediction model which will consider a multitude of factors, including inflation, property value appreciation.

We will address further this issue in the next segments of the paper.

Chapter two: XTerra
The Business Model

XTerra - Our Business Model

XTerra can be practically seen as a **real estate broker** who provides tokenization-as-a-service (TaaS) to facilitate liquidity in the real estate market for sellers and investors with any level of financial capability. In that sense, it was decided to run the underlying business as a centralized limited liability company, or GMBH in Switzerland, to ensure the security and stability required for efficient tokenization of the real estate industry. Hence, we do not provide any utility token of XTerra as means to provide funding but aim to receive it through the more traditional means of Venture Capital Funds and the later possibility of an IPO. XTerra made this decision, as we see the future to be one where regulated companies use blockchain technology as a tool to improve already existing processes. This will be further aided by the issuance of CBDCs from central banks which will then be used as a payment vehicle for on-chain transactions. We plan to utilize the blockchain technology broadly in two ways: **TaaS** to facilitate ownership to everyone through the public ledger and a **public, centralized exchange** to drive liquidity into the market. In a subsequent stage, we will make use of the blockchain's unique capability of automatic contract execution to facilitate a new way of **collateralized lending** without any requirement of bank involvement.

We offer TaaS solutions to real estate owners. Our platform will **connect property owners to retail investors** by offering security tokens on listed assets. The way it works is the following: first, an owner sends a request to tokenize a property. Only after completing the KYC & AML compliance procedure, the request is accepted. Furthermore, XTerra has an additional screening procedure in-place that uses **AI** and further research to evaluate the properties on several key variables such as future valuation potential, occupancy rates and location. Hence, we ensure that token investors have a guarantee of investing in a property that provides **attractive returns**. This removes further barriers for the investor in terms of carrying out lengthy research to correctly value a property.

After the completion of all regulatory requirements and screening, an **NFT** will be issued representing the underlying real estate asset on the blockchain. This NFT is fractionalized to allow the recording of separate ownership of X sub tokens across different account holders. Subsequently, a **security token offering (STO)** is placed on our platform which will be available to all kinds of investors around the world. Since the owner can be interested in selling the asset as soon as possible, we will act as co-investors in case he/she fails to sell all the tokens in a certain amount of time.

Retail investors willing to invest into tokenized real estate will likewise have to follow KYC & AML compliance. After that, they get access to our platform which will show information on all properties currently on sale and their detailed characteristics: location, size, construction date, description and photos, information on tenants and rental

payments, total property value and token price. While we believe CBDC to provide the future means of blockchain payments, for now we will work with Stablecoins, as it is currently the only crypto payment method that does not display high exchange risks, as means for property investors to purchase tokens and to reap the rewards.

Our tokenization service provides the unique opportunity of **true property ownership** under a **fully decentralized governance** model. Thus, each token owner can enjoy the benefits and the responsibilities that come with owning a property. Monthly rental payments are to be split among token holders proportionally to the stake they have. The blockchain's low transaction costs further allow for the payout of rental income also on a **daily basis**. Customers will be able to see the balance deposited in our contract updated in real-time and **harvest their rewards whenever** they want. Furthermore, they will benefit from almost guaranteed property appreciation by the time they decide to sell their tokens. Annual or bi-annual voting sessions will be carried out to make all necessary decisions surrounding renovation budgets and management. A residential president will be voted with various responsibilities like handling of all communication with an on-site management company that is indicated with every tokenized sale and taking care of all the day-to-day handling of the property.

Finally, the secondary market will facilitate the opportunity to **sell their tokens to interested investors at any time**, through the secondary exchange functionality. In the long run we envision a modernized form of real estate where purchases will be fu fully carried out on the blockchain and on the secondary exchanges, thus providing a full **transformation of the current market**.

Geographical Positioning

Although the market is almost geographically unrestricted for investors (the demand side) as there is virtually no boundary to how distant an investor's base is from its revenue streams, **the same does not apply** for the asset seller (the supply side). Indeed, in the initial stages of the business, Xterra will only allow sellers to sell assets which geographically in the same country of jurisprudence where the company will be operating. In many countries, currently, legal limitations exist that prevent one to become the owner of a real estate asset by purchasing its digital tokenization.

By focusing mainly on the European market, such limitations restrict the set of potential countries/regions where it can be possible to start Xterra's operations. At the current stage, only Switzerland, Luxembourg, and Liechtenstein don't have this kind of restrictions, which makes them the only possible candidates as the base for the company launch. The choice of the country is overwhelmingly biased towards Switzerland, and this comes from a mere housing stock comparison between the

countries (a crucial term to factor in when the country, a city must be chosen which, after a careful analysis of the local markets, ends to be **Geneva**. We will now explain more in detail why this city outcompetes all the other Suisse cities.

When housing market attractiveness indicators are considered from a demand standpoint, Geneva does not lead the ranking. Indeed, Geneva has half the population of Zurich, the population growth rate is lower to Bern, and it does not enjoy even the strongest immigration inflows. However, there is a statistic where Geneva takes the lead, which is the **Vacancy Rate**, the percentage of rental assets that are vacant, as low as 0.51% in 2020. This is a critical indicator for our company's market attractiveness given that rental income is one of the main sources of profit for our investors.

From a supply standpoint, Geneva has remarkable features among which the **Investment Volume** 3.7 bn (in 2020) against 1.3 bn of Zurich, the relatively high Median Rent Prices 410 CF/sqm and the increasing speed at which a house is sold on average (38 days). These factors, the increasing prices and demand, together with the absence of exclusivity (a feature that characterizes many other Suisse cities where some investors are forced to the higher risk-return profile of restructuring investments) support the choice of Geneva as the ideal candidate for the launch of the XTerra geographical base.

Profitability

XTerra will generate revenues through several different channels. Firstly, the main income stream will initially come from a **1% commission fee** that is charged to the seller of the house. This fee can be considered similar to the brokerage fee in a non-blockchain market, however we have the unique advantage of offering fees significantly lower than the 2% typically offered by traditional real estate brokers. Moreover, potential sellers can **benefit from higher revenues** on their house as a result of the significantly reduced fees. XTerra can charge such low commission fees, as we significantly reduce the typical costs of individual property marketing and staffing that brokerage firms have, by providing a nearly **automated framework**

for the tokenization and sale of real estate assets.

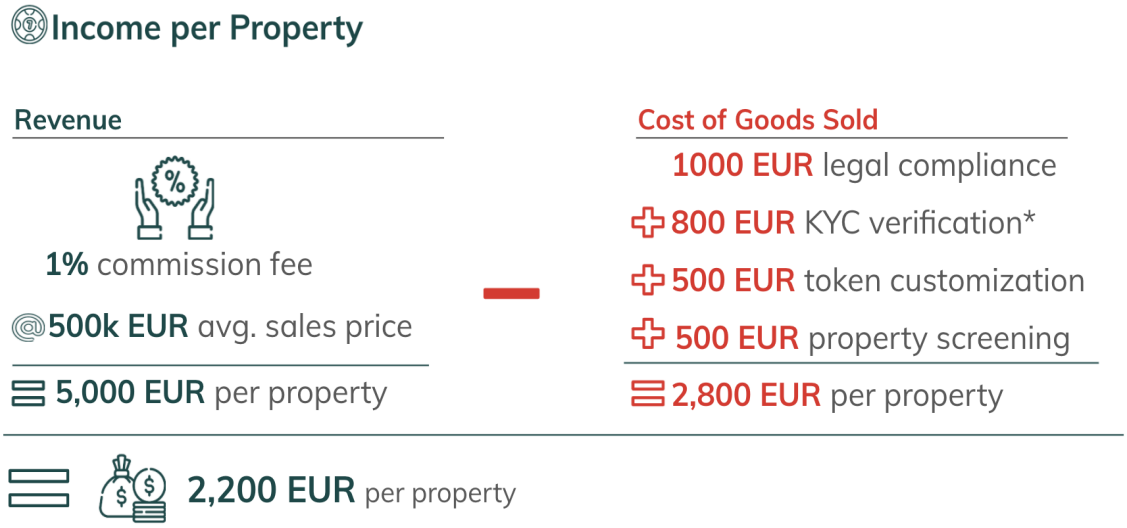
In the long run, as we envision tokenized real estate exchanges to become the major form of investments in the sector, the main profits will come from our centralized exchange. In line with current fees, we will charge a 1% commission on the sale of any tokenized real estate assets. Additional fees and income streams are under current consideration.

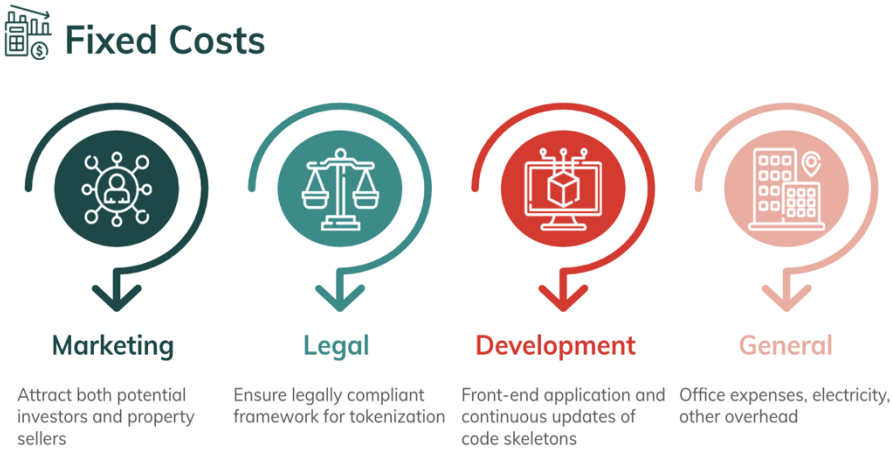
Should a community of owners decide not to want to involve themselves in the governance of the property, XTerra will take on the role of residential president and handle all administrative matters together with the on-site property management company by earning again the typical fee paid out to the manager. Additionally, an exchange fee can be charged for the transfer of monthly rental income from real currency in EUR or CHF into Stablecoins such as USDT.

Finally, to highlight that the implemented fees will generate long-run sustainable revenues, we provide below an overview of the estimated income generated from the sale of a singular tokenized asset. As the secondary exchange functionality will be implemented in a 2.0 version only, no profit overview has been provided for such an exchange yet.

As shown in the table, the tokenization of real estate assets provides a high variable margin, at 44% or an income of 2,200 Euro per property. Hence, there should be no difficulties in long-run profits, provided that enough token offerings are issued to cover the various fixed costs. An overview of the various fixed costs without direct cost estimation is provided in the second infographic in the next page.

Another important consideration from a financial perspective are the large initial capital requirements in form of cash collateral deposited in the smart contract on an STO that can be used to buy out tokens from the seller if not all tokens have been sold to investors after a certain time period. Hence, we can ensure the seller receives a similar experience as a sale in the traditional market through setting a competitive time frame after which we purchase the remaining token at a preset -

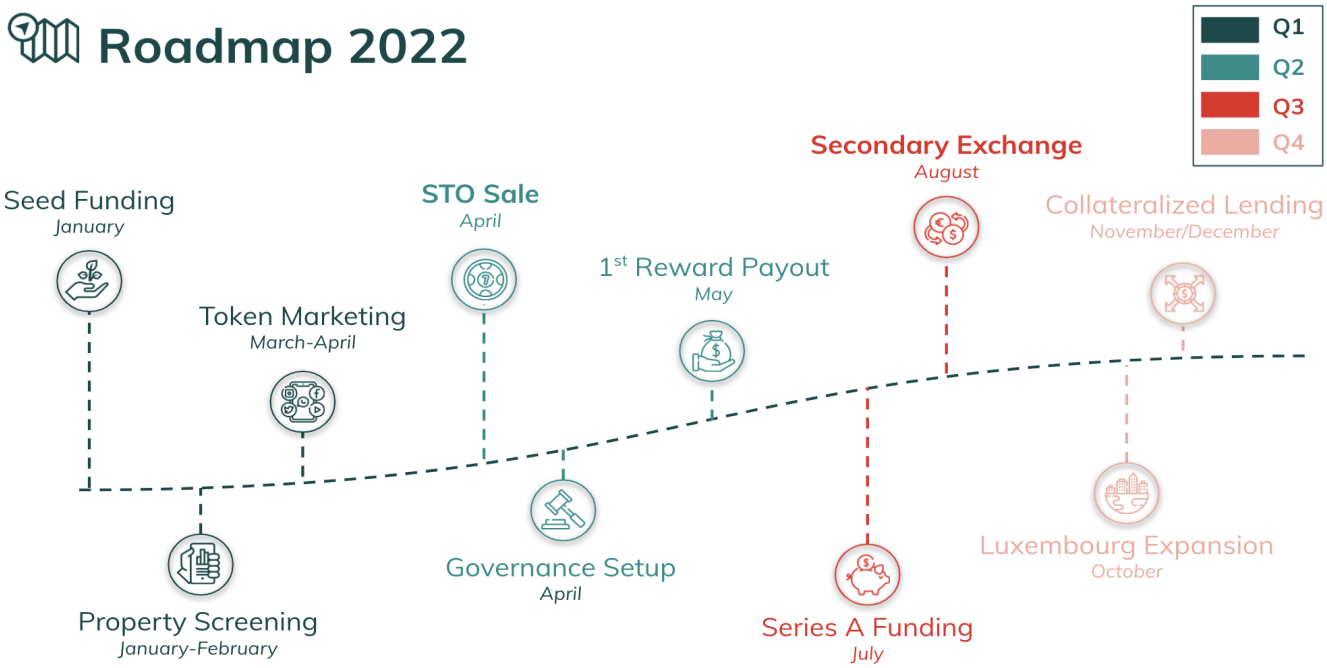




lower than listing - price. While this does require initial liquidity of some 100,000 EUR, it can be viewed at the same time as an opportunity to build a lucrative real estate portfolio of tokens purchased at attractive prices. Nonetheless, an investor will have to be found to support this kind of liquidity provision for the first asset sales.

Future Outlook

To summarize better the goals and requirements outlined in the Business Model above, we hereby proudly present our roadmap for the Year 2022.



Chapter three: Market Research
The External Environment

Market Research

While we believe to stand at the front of transformation, it must be acknowledged that Real Estate is a long established and competitive market and hence it is essential to understand the various alternative vehicles and competitions out there.

The **Real Estate (RE) market** is well-known to combine **illiquidity** with a very **low** amount of **volatility**. This makes it an attractive source of income return, especially when interest rates are low and an opportunity to diversify the portfolio, since usually RE assets are negatively correlated with stocks. Other incentives to invest in Real Estate are given by the general lower amount of principal-agent conflict and by the fact that this sector can be considered inflation-hedging since GDP growth grows as demand for RE does. As already stated, the main issue is the low level of liquidity, which, if put together with the high amount of capital required as an entry barrier, makes the RE market not as appealing as it may seem at first sight. Some tools have been devised to circumvent these problems.

The most popular is the **mortgage**, which lowers the entry barrier and allows one to invest money in other markets while taking the control of a property by only purchasing a little fraction of it. However, in order to get a mortgage one must satisfy many strict requirements, and, in many cases, this turns out to be inconvenient with respect to the direct purchase. In general, one should be able to prove some degree of wealthiness to be allowed to mortgage a house, which makes it not as effective as a "lowering-entry-barrier" tool. Finally, mortgages are handled exclusively by banks, centralized authorities carrying default risk that should be considered when investing.

A powerful alternative to the traditional process of buying a house with the purpose of renting/making a capital gain out of it, is investing using **REITs**. They make RE a more liquid market by lowering the amount of ownership guaranteed to the investor. Besides the **high commissions** REITs are usually also likely to follow trends similar to the ones of stocks (since they trade on the stock exchange), decreasing the power of the potential diversification feature RE assets are usually endowed with. Apart from renting, flipping houses and REIT many other tools have been developed to exploit the low volatility of this market.

Real Estate Investment Groups allow you to buy a house without the need of managing it, in exchange of a percentage of the income produced by the house, acting like a sort of small mutual fund. Furthermore, **Real Estate Mutual Funds** invest into RE operating companies and REITs allowing diversification, liquidity and usually providing insightful analysis and information. Even if REMFs solve many of the problems of this market, they require non negligible commissions and still the degree of ownership over the properties is null or very low depending on the kind of investments.

How we stand out in the market

Existing players in the market can be classified along three main axes: the degree of ownership of the underlying asset, the extent of use of the technology, and the level of fees.

Firstly, in the extent of use of the technology, there are some players that only use the blockchain technology partially. Some propose a crypto with inner value based on income reinvestment and price mechanism linked to a portfolio. Additionally, some use tokens to raise capital and try to combine benefits of real estate assets with the technological possibilities of smart contracts in the blockchain. They basically propose an updated version of REITs exploiting the functionalities of smart contracts.

Additionally, some players use technology extensively, fully managing to tokenize the underlying property itself.

Secondly, for the degree of ownership they offer. Here, there are some companies that offer a system of tokenization property identifying properties through a series of **LLC** acting as intermediary between the token owner and the Real Estate property. This structure tries to minimize the management and maintenance related responsibility of investors, while granting power on important decisions such as selling, rebuilding, or restoring.

On the other hand, there are few players that are guaranteeing to investors a higher degree of ownership, for instance by targeting only commercial investment properties. In this case the procedure is clear: they tokenize a house on sale, crowdfund the sale and the property holder receive the amount to which the house was sold for in ETH or FIAT money. Furthermore, token owners have voting rights proportional to the stake they own which can be exercised through a DAO.

While several competitors exist with the goal to tokenize real estate, it should be noted that the market, unlike art NFTs, has thus far not received the hype and attention it deserves and hence no company has yet received any significant amount of attention.

We believe that our unique and extremely competitive position deriving from a combination of low fees, whilst providing the highest possible level of ownership will leave us in the perfect position to **lead the real estate tokenization race** upon the inevitable kick start of the field.

Chapter four: Technical Analysis Components Breakdown

Technical Overview

In this chapter, we aim to give an overview of the business idea from a more technical point of view. First, we will start with the most suitable protocol analysis and selection for our purpose and then, after a brief focus on Layer 2 blockchains, we'll move on to all the technicalities of the tokenization and offering of assets.

Protocol Analysis

The correct selection of the **underlying protocol** on which each of the respective asset's token contracts will be recorded is a crucial aspect for the success of XTerra. Firstly, the blockchain protocol needs to be flexible enough to allow the implementation of the various regulatory requirements regarding the transfer of ownership and tokenization of a tangible asset. Furthermore, the underlying blockchain needs to guarantee a stable environment characterized by **low transaction fees, quick finality and limited possibilities for forking** to erase the NFT from the existing main chain.

To provide a more detailed overview on this, we have analyzed all the various facets that we have to carefully choose for our purpose. In the following section, you can see each required functionality with a brief description. Later, a selection of blockchain protocols has been studied and a final choice has been made.

Protocol Requirements:

1. **Publicly available information**
   Information about the ownership of the real estate properties should be easily accessible by the Swiss government for transparency and controlling. To do so, also the users addresses should be posted on a public blockchain
2. **STO contract support**
   To ensure a secure and compliant tokenization of each real estate asset, the blockchain protocol should provide some development support or skeleton code for issuing a legally compliant STO. We can then extend this code to provide additional information according to the need
3. **Low Transaction Fees**
   The relatively low yield nature of the project and its core concept of low entry barriers requires the presence of low transaction fees otherwise, the competitive advantage could be lost
4. **Stablecoin/CBDC payouts**
   As we avoid the dangers of price volatility of most of the altcoins currently in the market, the protocol needs to be based on the use of stablecoins. In the long run, ideally CBDC will be integrated
5. **No forking**
   A fork may result in multiple records of the same NFT across different branches of the same

chain, thereby endangering the unique verifiability of ownership of the underlying asset. To tackle this issue, the blockchain should limit or completely restrict forking

6. **Quick Finality**
   For what regards the collateralized lending feature we would like to implement subsequently, the protocol should be designed such as to allow quick registration within one of few blocks of the lending/borrowing. It is essential to reach the highest speed of verifiability to assess whether transactions have gone through or not
7. **Scalability**
   As the potential number of real estate assets which can be tokenized is nearly unlimited and a secondary exchange of tokens allows for a high number of trades to be potentially executed, we aim to build on a protocol that can be upscaled without a whole recoding session
8. **Security**
   It is obvious that security must be ensured such that no malicious attacks can overwrite the ownership of the underlying asset. This is fundamental to build trust among our customers
9. **Popularity**
   The network needs to showcase an active and numerous existing user base to ensure sufficient potential customers in the initial stages of the business

We have chosen four different protocols, Ethereum, Solana, Algorand and Avalanche, to conduct a deeper analysis and to understand which one can be the most suitable for us. Each of the cryptocurrencies has been analyzed across various points, such as the inclination to forking, the availability of information, the popularity, transaction fees, scalability and many others.

After a careful review, the **Avalanche protocol** has been chosen as the optimal platform as it provides a fast, secure and low fee environment that is designed to work well for financial institutions' apps. Furthermore, its integrability with any virtual machine, and therefore any other blockchain protocol, allows the programming of applications in Solidity via the EVM, whilst potentially connecting with any other blockchain protocol supported by Avalanche.

First or second level layer

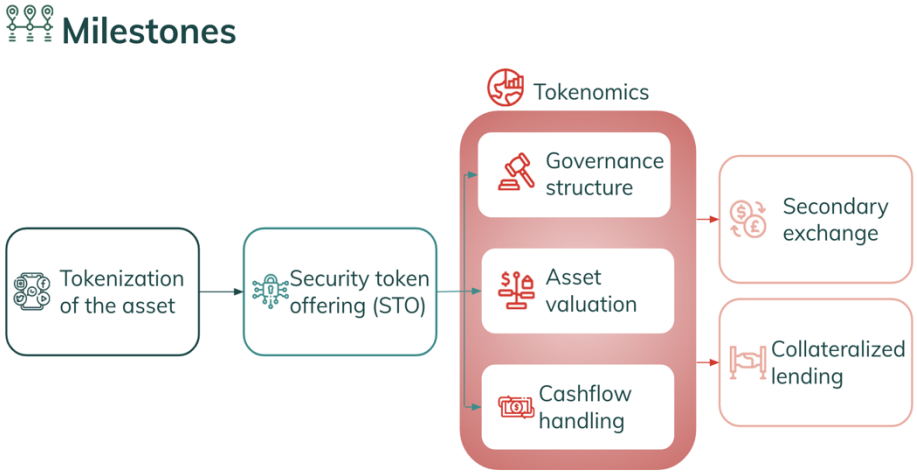
Given the increasing popularity for the topic, various blockchains have experienced difficulty in handling all of the transactions. When a network becomes clogged, pending transactions are stored in the memory pool and take longer to process. To exploit this, miners have begun to prioritize transactions with greater gas prices in order to confirm them. This pushes the transaction's minimum cost even higher. Layer 2 scaling aims to solve this issue by ultimately providing greater transaction speed and transaction throughput.

We found that this solution could result very beneficial for our application, also given the relative illiquidity of the underlying asset class by nature. In fact, handling the entire processing load with a specialized Layer 2 blockchain and then ultimately reporting everything to Layer 1 for result finalization, would allow us and our investors to save money on gas fees, while keeping their experience unaltered.

Various layer 2 solutions have been assessed. While some of them presented a good potential, the workstream has been put in standby while we focus on obtaining the MVP using the mainchain. Future implementations will take into consideration this solution.

Technical Milestones

From a technical perspective, there are six different milestones to consider: the tokenization of the asset, the initial sale of the token (through an STO), the governance structure, the cashflow handling, the creation of a secondary market platform and the collateralized lending function. The exact technical pipeline required can be viewed below.



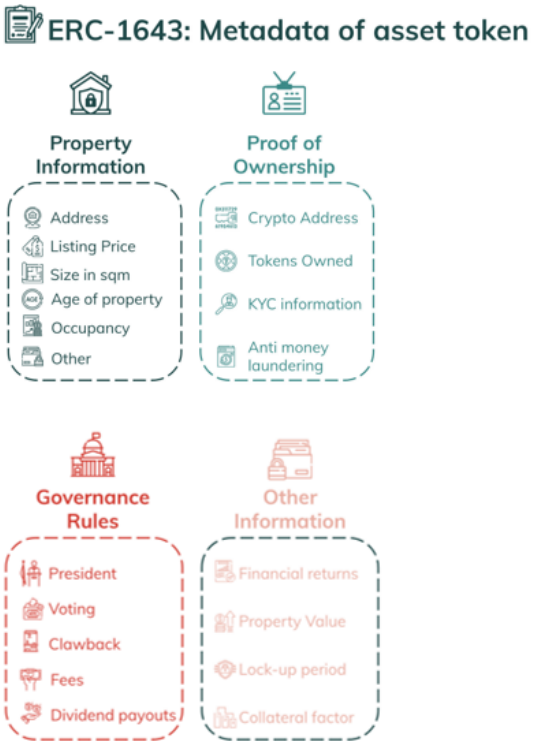
Tokenization of the Asset

As a high-level overview of the different functionalities described in the figure above was provided in the Business Model, we can straight away dive into the technical details of how to get it setup. Before **tokenizing the asset**, given the difficult nature of the transaction, an entity (either natural or legal) willing to sell his property should provide the proper legal documents required by law. Moreover, each property needs to pass through an internal screening from our exchange, where the asset's conditions will be checked. Also, its attractiveness and potential long-term value appreciation, together with other factors that aim to determine its appetibility in the market will be evaluated. The legal factors will be assessed **off-chain** by a third-party provider and, if authorized, the property will be approved to be positioned in the exchange, ready to be tokenized.

The tokenization of the asset is achieved through the auxiliary of two Ethereum Request for Comments (ERC) contract standards: the ERC-1410[3] and the ERC-1643[4]. The ERC-1410 enables the creation of a **Partially Fungible Security Token**, which enables a Non-Fungible Token (representing the property) to be splitted in a fixed number of partitions that are indeed fungible and can be owned by multiple users. In addition to the ERC-1410, all the relevant metadata that a property should display for any compulsory legal aspect is included

[3] https://github.com/ethereum/eips/issues/1410
[4] https://github.com/ethereum/eips/issues/1643

through the adoption of an ERC-1643 smart contract. It provides the standard to support **attaching documentations to smart contracts**, specifically security token contracts, aiming to carry metadata that can be interrogated at any point in time by the interested parties, **everything stored on-chain**.



Finally, depending on the proposed selling monetary value, the asset is divided in a chosen number of sub tokens (partitions). The price of each sub token is simply the sell price divided by the number of decided partitions, and this consequently determines the minimum entry fee. For example, if a property's selling price is 500,000 USDT and the number of chosen sub tokens is 5,000 then each partition will initially cost 100 USDT, which corresponds to the minimum entry price for an investor.

Thus, we have chosen three different tiers as outlined by their minimum required initial investment.

Investment Tiers

Tier	Minimum Investment	Value	Property type
The Starter	100 CHF	<400k CHF	Single apartments, simple one-family homes
The Professional	500 CHF	<2M CHF	Upscale family homes multi family homes
The Tycoon	5,000 CHF	>2M CHF	Luxury villas, Apartment buildings Commercial space

Initial Sale of the Token

Before the actual security token offer takes place, in the pre-sale phase, each investor needs to get through an **approval process** that is carried out by a third party company. The investor needs to submit legal documents, such as **KYC** (know your customer) and **AML** (anti-money laundering) to be authorized to make any purchase. If the prospect gets approved, an oracle transmits the successful screening and the data submitted get propagated **on-chain** and stored through a ERC-1594[5] contract, altogether with the previously described ERC-1643. Moreover, the user gets notified of the positive outcome. For each listed property there is an initial unique **security token offering (STO)**, that is managed by a smart contract which acts as an accumulator. The sale of the tokenized asset is bound to happen in a relatively small and fixed amount of time, in which the accumulator locks in the amounts invested by interested customers.
The length of this **accumulation period** is externally dependent on the average sales

[5] https://github.com/ethereum/eips/issues/1594

period time in the asset's location, and by external factors, such as a potential lower willingness to accept from the original owner of the property.
After the waiting period has ended, an oracle computes the percentage of subtokens sold and depending on this, different **scenarios** may arise.

If the property gets fully sold, or the chosen threshold is achieved, the accumulator contract automatically transfers the corresponding amount of sub tokens from the ERC-1410 to the investors. The amount gets managed by our exchange, a part is kept as commission and the rest is transferred to the original owner of the property. Moreover, the ERC-1410 not only serves as the unique representative of a specific property, but it also encompasses **on-chain** the public ledger containing the amount of sub tokens owned by each holder. In addition, a **disaster deposit** for the property is created, where each token holder is required to put 5% of its initial investment. The disaster deposit will only be refunded when the owner of the sub token decides to sell his token, or the property gets sold in the primary market. If instead the lock-in investment does not achieve the established threshold, the accumulator smart contract automatically returns the initial investment to the investors. In this case, the ERC-1410 will remain in place, and the seller just remains the contract owner, so the property results to be unsold.

Governance

Whenever a property gets sold, the investors become an **active part of the advisory board**. These agents can express their preference on a variety of topics, such as the election of a residential president, the release of funding for renewal, and in general the most costly and important decision that needs to be taken when managing a real estate. The **voting process** happens through a decentralized autonomous organization (**DAO**), where the importance of the vote is proportional to the number of sub tokens in possession, every stakeholder can express its opinion and each decision is 100% community driven. The governance of each property is composed of several passive and active stakeholders, depending on the share of sub tokens they hold and the willingness to engage in the management of the property.
Each property must have a **residential president** and an **on-site administrator**. The residential president has a critical, ambitious and rewarding role. Firstly, it is voted amongst the current stakeholders through the DAO mechanism. In order to ensure compliance to the role and incentivize trust, each candidate needs to fulfil specific requirements, such as the obligation to own a **minimum level** of its shares (5%) and maintain it throughout their mandate. By being the residential president itself an owner of the asset, the compensation conditions are voted by all stakeholders at the beginning of the mandate, when the election is about to happen, and doesn't need to be the same throughout time. The duties of the residential president are mainly

administrative: from organizing and leading the yearly meetings, to any ad-hoc meetings (such as when an unexpected event happens, and the disaster deposit needs to be used). Moreover, its main role is being the middleman (or point of contact) between the on-site management, the administrator, and the other investors. Thus, all the communication and results of each ballot gets propagated through the residential president bidirectionally. Furthermore, the residential president role and its conditions gets **re-voted on a yearly basis** in order to ensure full compliance to its duties. Finally, the residential president role can turn into an exciting learning and profitable experience where one can gain experience in the real estate business by managing a whole property without having to carry out the whole risk.

The **on-site administration is entirely off-chain**, and it does not necessarily need to own any token share. It is responsible for collecting monthly rents, solving disputes, planning needed renovations and deciding on the year's budget. Depending on the severity of the action taken, the on-site administration can either handle the management of the property without the need of token holder's voting or initialize a budget request. The latter is communicated to the investors board through the residential president.

The **voting process** is initiated by the residential president with the auxiliary of a smart contract. Its constructor provides a *_ballotOfficialAddress* method, which registers the address of the initiator of the contract, enabling the other stakeholders to check if that is an official ballot. Moreover, it provides a *_ballotOfficialName* and *_proposal* which represents the unique ID of the ballot and the proposal it is carrying on. At the end of the voting time, the *winningProposal()* function will return the results with the largest number of votes. As previously stated, the impact that each stakeholder has on the ballot is **proportional to the percentage of sub tokens owned**, retrieved from the interaction between this contract and the ERC-1410 contract that represents the property. Finally, as previously anticipated, the decisions are entirely dependent on the severity of the planned action. For example, a simple majority is needed for renovation budgets or increase in rent prices. However, for the sale of the asset on the primary market, since all the token holders must liquidate their position, a simple majority is not enough. Consequently, once a decision has been voted on, all the investors have the obligation to comply with the choice made, providing the necessary funds in the agreed proportions and time.

The **compliance process** is managed directly by our company which retains the ability to penalize and/or liquidate the positions of those users that do not fulfil their obligations (function included in the ERC-1410 contract), which will firstly be handled in a case-by-case situation, together with the respective residential president, but will be automatized in the future. Moreover, the liquidation function is included in the smart contract that gives the possibility to the company to immediately liquidate a user that has not complied after having

received more than three warnings. The shares of the non-compliant user are firstly proposed to the current owners through a first come first serve modality at a base price, if not sold we will buy them at a lower price.

Cashflow Handling

From a technical perspective, the **handling of cash flows** needs some particular attention. In this context how cash is flowing is pretty straightforward as shown in the next diagram.

The on-site administration collects the rent (in EUR or CHF), then a smart contract automatically exchanges the amount into stablecoins (CBDC in the future) that gets daily allocated to each investor's address proportionally to the share of sub tokens owned. Fees will be retained by our company for the handling of the conversion and the allocation of daily funds. However, we do not convert the entire amount received in stablecoins, but first the incurred monthly expenses, such as on-site administration fees, our company fees and property's utilities get deducted from the entire amount. Secondly, an already established monthly percentage gets allocated to a renovation fund. Therefore, the sum of these daily dividends throughout a month will not be exactly equal to the rental payment. In particular, for the daily dividend mechanism to be in place, it needs to be stated that in the first month stakeholders will not receive any dividend.

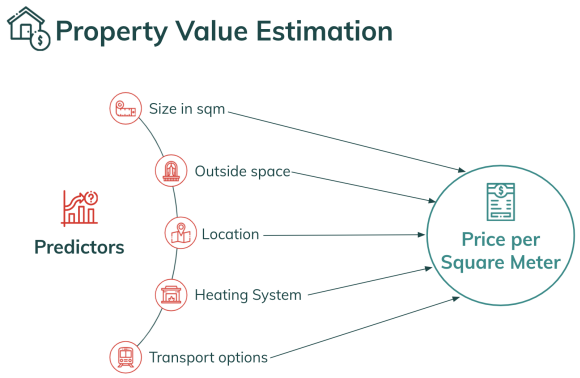
Secondary Market Platform

The **secondary market platform creation** is the ambitious and next step of our roadmap, where we allow registered customers to trade and/or sell their sub tokens in a dedicated platform. From a merely technical perspective, the platform will be a collection of smart contracts that will enable only customers that have provided the right legal documentation to engage in transactions with others. Let's see a simple example: user A wants to exchange USDT for a X% of sub tokens of property Y, which is declared in the on sale window by User B. The smart contract (Offer) will first check the address that has called the contract, and it will look at the approval (stored in the ERC-1594 as previously described). If approved, the smart contract will call an external oracle, a machine learning model which predicts the price of that particular asset Y of interest as of today. Then it will return the total price of the transaction, namely X * P_T. If the buyer is happy with buying X% of Y asset at X * P_T, then another smart contract is called, which locks the amount offered and triggers User B with a notification. If User B is happy with the offer received, he will solve the contract by accepting the amount and transferring ownership of those sub tokens to user A. The adoption of an asset evaluation

prediction procedure helps in closely binding the value of each sub token to the real asset value, in order to avoid any form of exaggerated price speculation. However, it is still unsure how exactly we will link the value of the asset to its current price, but two techniques will be tested and evaluated.

Asset Valuation

The **asset valuation** can be achieved in two ways: firstly, as the result of a **statistical procedure** which provides a close estimation of the perceived value of the asset, as of today. Secondly, with the technique of comparison, that just uses a price-only Nearest Neighbor technique. In both cases the algorithms are ran **off-chain** but their outputs are stored **on-chain**, through an oracle called inside the Offer smart contract. The data that is given as input to these models comes from a web scraper which retrieves information from popular listing websites of residential assets in the same area as the target one. The first proposed asset evaluation technique is shown in the next figure, where the target variable price per square meter is modelled starting from the reported regressors.



In the second case, the price per square meter is simply predicted as the **average of the square meter price of the closest geographical assets**. However, this is still a limitation for our company, given that there is uncertainty in the data sources that will be used, due to the variety of Switzerland listing websites, and limited access to historical data of a particular neighborhood. Moreover, from a technical perspective, we still do not know where to run and how to integrate such a model with the on-chain information. Both data and technical current limitations will be addressed by further exploration of different data sources and evaluation of different possibilities of integration of oracles with the Avalanche blockchain.

Collateralized Lending

Finally, the last step of our roadmap is centered around the creation of a **collateralized lending function**. A token holder may want to **exploit the exposure** he can sustain by holding a real estate property, and so borrowing money without necessarily selling its sub tokens. By depositing the sub tokens in the **XTerra protocol**, he would be provided with additional liquidity, in the form of stablecoins, to further engage in the secondary market or simply invest in other cryptocurrencies.
Through the platform, the investor can borrow by:

a. Depositing the amount of sub tokens inside the XTerra protocol
b. Borrow stablecoins using the sub tokens as collateral
c. Use the borrowed stablecoins to enter the desired position

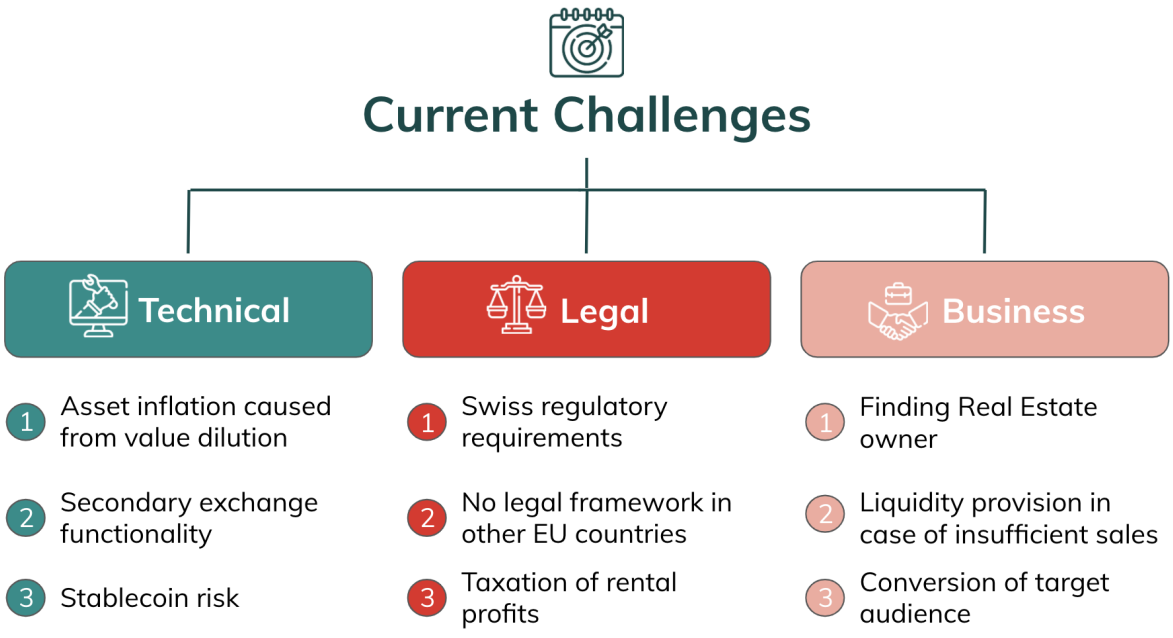
Chapter five: Conclusions
Challenges and Opportunities

Challenges&Opportunities

All the benefits brought by real estate tokenization do not come at no cost, as it can be expected.
There are currently several challenges that can be broadly divided into three different categories as outlined in the figure below.

Clearly, there are many roadblocks that need to be overcome in the near future, however we believe that there is **nothing that can hinder our success**. The exact functioning of the token pricing and thereby the secondary exchange mechanism, while a challenge, can be designed to function similarly to other existing mechanisms of exchange and stable value coins. The same reasoning extends to the taxation issue. We furthermore believe in our **ability to attract willing investors** to an idea that has a **solid business foundation and strong future outlooks**, whose liquidity can help ensure that real estate owners can be incentivized to offer their properties into a tokenized sale.

Moreover, the continuously increasing adoption of cryptocurrencies and eventual rollout of CBDC will open a world in which real estate investments can be made with truly secure and stable digital money for any type of audience across all the European countries. While this may take some years to come, we believe that **XTerra is sitting at the forefront of transforming perhaps the world's most important industry into the world of digitization and decentralization** and will be made possible through the worldwide adoption of the unprecedented advantages of blockchain technology.



Donations

How to contribute

Please use the following wallet address to donate AVAX, ETH, NFTs and other ERC-20 tokens:

0xa0eDF1FAa401C94A34bc5f246850674ECC3E35fB

XTerra is coming: sit back, relax and enjoy the ride with us

Let’s change the future of Real Estate