Barça Tokenization

BLOCKCHAIN TECHNOLOGIES

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I N D E X

EXECUTIVE SUMMARY

Introduction

During the last decades, we have been able to observe a progressive evolution of football clubs and its management model. Analyzing this change of paradigm and adapting to the moment and the public's necessities is an indispensable condition for any sports club in order to gain a competitive advantage and anticipate the future. The digital age is allowing the emergence of what we call clubs of the fans, where the clubs with more growth and better performance in the near future are the ones which manage to accumulate the higher number of fans around the world and involucrate them in club decisions and management. But how can F.C.Barcelona take advantage of this tendency and engage its fans to dedicate vocation and time to an institution that produces real results and consequences?

Abstract

Being the football club with the largest number of fans around the world, with more than 300 million, Barça must take profit of this latent asset and position itself as a reference institution when it comes to innovation and community management. We believe that new technology, and more specifically, blockchain and asset tokenization, can become the perfect tool to accomplish this goal.

Our project consists of building an ecosystem which allows F.C.Barcelona to monitor and manage in an efficient way this potential asset which is the mass of Barça fans. In other words, the club must tokenize all the latent assets, which are not few, that are born when we consider the opportunities that the blockchain and tokenization offer us. This digital environment must revolve around the club itself and not third parties who take advantage of it. Barça must become its own central bank and maintain the control of this virtual economy which will represent an important part of the assets of the world-class sport clubs.

RELATED WORK

The potential for blockchain technology to improve different areas of business operations and engage fans in fresh and creative ways has recently piqued the curiosity of sports teams and organizations. Blockchain's decentralized and open nature presents an enhanced fan involvement, safe ticketing systems, efficient player transfers, authenticated goods, and open sponsorship agreements. For instance:

1. Fan Interaction and Rewarding:

The use of blockchain technology has been used to increase fan involvement by offering exclusive opportunities and rewards. For instance, the blockchain-based platform Socios.com has partnered with a number of football clubs, for instance Paris Saint-Germain, to enable supporters to vote for their favorite teams using tokens [3]. This engagement concept increases supporters' sense of involvement and loyalty by giving them a say in some team decisions.

2. Authenticity and Ticketing:

Blockchain has the ability to completely transform sports clubs ticketing processes by providing transparency, prohibiting the sale of fake tickets, and making ownership verification simple. A good example is the alliance between blockchain technology firm ConsenSys and NBA team Sacramento Kings [6].

3. Player Contracts and Transfers:

By employing smart contracts, blockchain technology can speed up player transfers and contract negotiations in sporting organizations. On the blockchain, smart contracts are self-executing contracts with preset conditions that guarantee security and transparency. West Ham United, an English Premier League team, has tested a Databroker DAO-developed blockchain-based player transfer system [1]. With less administrative work and complete transparency throughout the transaction, the system promised to streamline and automate the transfer process.

4. Consumer products and collectibles:

Sports memorabilia and collectibles may now be authenticated and have their ownership history tracked using blockchain-based technology. Leading the charge is the NBA, which in partnership with Dapper Labs introduced the NBA Top Shot platform, which uses blockchain to produce and exchange digital valuables called "moments" [4]. These moments represent memorable highlights from NBA games, and their scarcity and ownership are secured on the blockchain, creating a vibrant marketplace for fans.

5. Sponsorship and Partnerships:

Blockchain technology can facilitate transparent and secure transactions in sponsorship and partnership agreements between sports clubs and brands. A prime example is the partnership between English Premier League club Wolverhampton Wanderers and Crypto Millions Lotto [5]. The deal involved the display of the Crypto Millions Lotto logo on the club's jerseys, leveraging blockchain technology to ensure the transparency and immutability of financial transactions.

BLOCKCHAIN TECHNOLOGY

A blockchain is a type of database, that is, a compilation of information that is stored electronically in a computer system. Databases are designed to contain large amounts of information for which anyone can access, filter and easily manipulate any number of users at the same time. Big databases host data on servers made by hundreds or thousands of computers in order to have the computing power and the storage capacity needed for many users to access simultaneously. Although a database can be accessible by any number of people, it is often owned and operated by a company or designated person with complete control over its operation and the data it contains.

A key difference between a database and a blockchain is the way in which the data is structured. A blockchain stores information and disposes it into groups, also known as blocks. These blocks have certain storing capacities and when they are full they are chained to the previously completed block, forming a chain of data known as a blockchain. All new information contained in a newly added block is compressed and added to the next one, thus linking a particular block to both the previous and the next one. When a block is filled, it is added to the chain and becomes part of that timeline. Each block in the chain is given an exact timestamp when it is added, recording both when it was included and the content with which it was filled. Although information can also be stored in other ways, in a blockchain the transaction account is primarily used to define the process of recording this information. A transaction includes the set of data that identifies this record of information, such as an identifier of the sender, the receiver, the amount of coins sent, the time they are sent, etc.

There are a number of intrinsic characteristics in the functioning of the blockchain, which make it a technology with great disruptive capacity. These characteristics are the following:

Decentralization	Transparency	Privacy	Security

T O K E N I Z A T I O N

Although blockchain is a new technology, the concept of tokens and their use is not. For example, tokens have been a unique data security mechanism in financial services to protect sensitive information such as credit card numbers, personal identification information and financial statements, among other uses.

The disruption is in the blockchain, because it has allowed us to see tokens from a new point of view and offer new services that we could not previously, due to the characteristics of the technology at the time. Now, when we talk about the term "tokenization", we mean the process of transforming the rights of a real-world asset into a digital token. Basically, tokens provide a complete or shared representation of any asset that has a specific value. Common applications of tokens are evident in payments and settlement of transactions between participants, but they also provide multi-ownership representation of previously invisible assets such as artwork, a music video, a public building, or even the representation of rights or obligations towards an asset.

Barça Token Definition

In the following section, we will explore the key characteristics of the tokens that we believe would be a perfect fit for the football club, enabling it to revolutionize its operations and establish a deeper connection with its fans. The token would aim to provide a sense of membership and engagement with the football club, giving fans a stake in the club's success. Some possible token properties and benefits include:

1. Ownership Rights: The token represents fractional ownership of F.C.Barcelona and specific club assets, such as stadium infrastructure or intellectual property rights.

2. Voting Rights: Token holders can participate in club-related decision-making processes, such as selecting team jerseys, choosing charity initiatives, or voting on strategic decisions.

3. Exclusive Experiences: Token holders gain access to exclusive experiences, such as meet-and-greet events with players, VIP matchday experiences, or participation in training sessions.

4. Merchandise and Discounts: Token holders receive discounts on official club merchandise and exclusive access to limited-edition items.

BLOCKCHAIN APPLICATIONS FOR BARÇA

In the dynamic world of football, new technologies and innovations are constantly being embraced to enhance various aspects of the sport. Blockchain technology, with its decentralized and transparent nature, has emerged as a powerful tool with the potential to revolutionize the operations of football clubs. Football Club Barcelona, a renowned club with a rich history, has recognized the value of blockchain and has identified three distinct applications within their organization. These applications aim to optimize talent discovery, improve the seating system, and address financial challenges imposed by regulatory frameworks.

1. Global Talent Discovery Network

The process of searching for talented players worldwide can be a challenging task since it is impossible to be present in all locations simultaneously and keep track of standout players. The Global Talent Discovery Network would make this task much easier for Football Club Barcelona.

This network consists of an online blockchain-based platform exclusively owned by Barça. The most important objective is to incentivize the collection of inputs and analytics from players worldwide who currently go unnoticed due to the limited reach of current professionals in this sector.

Any individual can join this international network of scouts and contribute data on players they have observed, such as players from small local teams or underdeveloped countries who lack tools for statistical analysis. Scouts are motivated to provide accurate data by the potential for future rewards based on the success of the players they report on. These incentives would be presented in the form of different types of tokens that could be used in various areas within the club.

By introducing these incentives, the Global Talent Discovery Network not only encourages scouts to actively participate but also emphasizes the value of proposing high-quality players. As a result, scouts who propose a promising player that ultimately proves to be talented would have their tokens multiplied by two, providing a substantial benefit for their contributions. This multiplier serves as a reward for their accurate evaluation and identification of potential talent.

Furthermore, the introduction of the multiplier system ensures that scouts have a vested interest in proposing players they genuinely believe have the potential to succeed. If a proposed player does not live up to expectations and is deemed unsuitable for the club, the tokens are not returned. This mechanism prevents

frivolous proposals and reinforces the importance of thorough evaluation and analysis by the scouts.

Through this network, the club can also leverage the participation of fans in the talent discovery process. This active involvement not only strengthens the connection between the club and its supporters but also generates a larger pool of data for player evaluation. The valuable information gathered from fans and scouts alike contributes to the identification of potential hidden talents, benefiting Barça's future recruitment strategies.

In summary, the Global Talent Discovery Network aims to redistribute the responsibilities of professional scouts, provide opportunities for unrecognized talents, expand the scope of player observation, and acquire dependable data and analytics through incentivized systems. By incorporating the multiplier system for accurate player proposals, the network ensures that scouts are motivated to contribute high-quality insights while discouraging frivolous submissions.

2. Free Seat and Ticketing System

One of the most common worries of the football clubs is related with its fans and the stadium seating system. Usually, the biggest sports teams in the world, such as FCB, have a big amount of seats in their respective stadiums. This implies that the stadium is more often to have non-used seats. In the case of FCB, the Spotify Camp Nou stadium holds an enormous amount of 99.354 seats, the Palau Blaugrana holds 7.585 seats. This situation leads to a point where not all the places are covered in each match.

In the FCB seating system we can find two main approaches. On one hand we find all the club members and on the other hand those people who do not belong to the club. Regarding the club members we can slice it into two possibilities; members with seats assigned and without seats assigned. In 2019, the number of members with assigned seats at Spotify Camp Nou was around 85,000, while the FCB had approximately 140,000 members. Since not every member attends all matches, there are a lot of seats that remain empty every game. This situation can cause problems on the ticketing system. For instance, last year the club had big problems in the semi-finals of the UEFA Europa League against Frankfurt Eintracht, since there were more than 30 thousand Eintracht fans when the maximum number of visitors in this league is 5 thousand. Reported by the club, around 7400 members and another 7000 Barça subscribers resold tickets to German fans.

Our purpose aims to fill the stadiums using the Blockchain technologies. We suggest using this technology in an easy, efficient and club helping way. The goal of this section is to encourage members with seats to notify the club, when they are not attending a certain game, so that the club can sell their seats to other fans who may

not have a seat. Indeed, the idea is to incentivize members to "sell" their seats in the Barça Blockchain System so there is transparency and track of the resales of the club. Therefore the reselling activity is more controlled by the club.

3. STOs for Fan-Funded Signings

Financial 'fair play' is one of the biggest headaches for European clubs, not just for FC Barcelona. Although the objective of economic control is to prevent the clubs from having losses and being 'sunk' financially, the rules are so difficult to comply with that, if a club does not have extremely healthy accounts and a very high income, it is impossible to enroll.

The control that UEFA exercises over European clubs in order to comply with good economic practices is done through a regulatory text called "UEFA Club Licensing and Financial Fair Play Regulations". There are many rules but we will summarize the most important ones:

- The clubs must prove that they have no outstanding debts with other clubs, with their coaches or players or with the Treasury.

- To prevent clubs from undertaking economic operations that are unrelated to their actual income, they are only allowed to spend up to 5 million euros more than what they earn in three years, and these limits may be exceeded in the case of direct contributions from their owners, in which case the limit will be a maximum of 30 million euros, an amount that decreases year by year.

- Failure to comply with the Financial Fair Play rules entails a series of sanctions that, depending on the seriousness of the breach and the possibility or not of restoring economic balance, range from a simple reprimand to disqualification or withdrawal of prizes obtained, including fines, withdrawal of points in sports competitions, or the prohibition of player registration.

In an STO, the football club would sell security tokens to investors, including fans and other interested individuals, in exchange for funds. The funds raised through the token sale can provide additional capital for the football club, to have a higher player signing budget (approved by the Fair Play Regulations).

PRACTICAL IMPLEMENTATION

It is important to note that out of the three applications proposed for Football Club Barcelona, we have only implemented the solidity contracts for two of them: the Free Seat and Ticketing System, as well as the STOs for fan-funded signings. The Global Talent Discovery Network, which involved transferring tokens to fans who proposed talented players, was considered too simplistic and has not been implemented at this stage.

1. **Free seat and ticketing system code explanation**

<u>Contract</u>

To provide a coding example of the management of the Free Seat Ticketing System, we have designed the TicketingContract.sol smart contract, which is a Dutch auction ticketing contract, where tickets are sold through a descending price auction.

In order to make the code easier to read, we have made two tables, one for the variables and one for other elements, each of which contains a brief description of each element:

Name	Definition
club	Stores the address of the club that manages the ticketing.
ticketPrice	Represents the current price of a ticket.
initialTicketPrice	Stores the initial price of a ticket.
auctionDuration	Specifies the duration of the auction.
minTicketPrice	Defines the minimum price a ticket can reach.
auctionEndTime	Stores the time stamp when the auction ends.
numTickets	Represents the total number of tickets available.
purchasedTickets	Keeps track of the number of tickets already purchased.
nextTicketId	Specifies the ID of the next ticket to be purchased.

The ticketOwners mapping associates a ticket ID with the address of the ticket owner.

The contract also includes an event named TicketPurchased, which is emitted whenever a ticket is successfully purchased. The event provides information about the ticket ID, the buyer's address, and the price paid for the ticket.

Name	Type	Definition
Constructor()	Constructor Function	Executed once during the contract deployment. Its purpose is to initialize various state variables and perform necessary setup operations. The deployer of the contract is set as the club address. The *ticketOwners* mapping is initialized by associating each ticket ID from 1 to *numTickets* with the address address(0), indicating that no tickets have been purchased yet.
buyTicket()	Function	Allows users to purchase tickets by specifying the desired ticket ID and sending sufficient payment. Several requirements must be met, such as the ticket ID being valid, the ticket not already being purchased, and the payment being equal to or greater than the current ticket price. Upon successful purchase, the ticket owner is updated, the *purchasedTickets* and *nextTicketId* variables are incremented, and the *TicketPurchased* event is emitted. If the payment exceeds the ticket price, the excess amount is refunded to the buyer.
endAuction()	Function	Used to conclude the auction. It checks if the first ticket has been purchased and if the auction end time has not been set yet. Once the conditions are met, the auction end time is recorded, and the ticket price is reduced by 1. If the new ticket price is lower than the minimum ticket price, it is set to the minimum value. Finally, the balance of the contract is transferred to the club address.
getAvailable Tickets()	Function	Returns the number of tickets that are still available for purchase by subtracting the *purchasedTickets* count from the total *numTickets*.

In conclusion, the Ticketing contract facilitates ticket sales through a descending price auction. The contract allows users to purchase tickets by making the required payment. The ticket price gradually decreases over time during the auction duration. Once the auction ends, the ticket price stabilizes, and the club receives the funds from ticket sales. The contract also keeps track of ticket ownership and provides a function to check the number of available tickets.

Test

We have also created a test python file which uses the *pytest* framework to test the functionality of the previously mentioned contract. We have provided a breakdown of what the test file does:

The *test_dutch_auction_ticketing()* function represents a test case. It starts by defining a *ticketing_contract* fixture using the *pytest.fixture* decorator. This fixture deploys an instance of the *DutchAuctionTicketing* contract with specified parameters, such as auction duration, minimum ticket price, and total number of tickets. The contract is deployed from the first account in the accounts array which symbolizes the club.

Two specific accounts are assigned: buyer and club, representing the buyer of the ticket and the club's account, respectively. Then we do three assertions to check the initial state of the contract. It verifies the initial ticket price, the owner of the first ticket (which should be the null address, the club), and the number of available tickets.

Next, we simulate the purchase of a ticket by calling the *buyTicket()* function of the contract. The *nextTicketId* variable is set to 1, representing the first ticket. The function is called from the buyer account, and a payment of 10 wei is attached to the transaction. After the ticket purchase, we verified the updated state of the contract. We check that the ticket price remains the same, the owner of the first ticket is set to the buyer account, and the number of available tickets is reduced by 1.

We introduced a time delay of 10 seconds using the time.sleep function to simulate the passing of the auction duration. Following the time delay, the auction is ended by calling the endAuction function of the contract from the club account. We check with an assert the updated ticket price after the auction ends. It asserts that the ticket price has decreased by 1 wei from the initial price.

To test the contract's validation, the test case attempts to purchase a ticket below the minimum price. We use the reverts context manager from the Brownie library to

assert that calling the *buyTicket()* function with an insufficient payment of 8 wei reverts with the error message "Insufficient payment".

Finally, the test proceeds to purchase the ticket at the reduced price of 9 wei. We again call the *buyTicket()* function from the buyer account with the appropriate parameters. We conclude the test by checking the updated state of the contract, that the owner of the second ticket is set to the buyer account and the number of available tickets is further reduced to 1.

In summary, the test case covers various aspects of the DutchAuctionTicketing contract, including the initialization of the contract, the purchase of tickets, the reduction of ticket prices over time, and the validation of payment amounts. The assertions ensure that the contract behaves as expected and maintains the correct state throughout the ticket auction process.

2. STOs for fan-funded signings code explanation

Contract

In order to provide a coding example of the application of Fund Raisings to achieve economic goals, we have designed the *FundRaisingContract.sol* smart contract.

To allow a better understanding of the code, we have created two tables, one for the variables and another one for other elements, which contain a brief explanation of each one of them:

Name	Definition
club	Public address variable that holds the address of the club associated with the fundraising. This variable allows the contract to keep track of the organization or group running the fundraising campaign.
totalFundsRaised	State variable that keeps track of the total amount of funds raised so far.
totalTokensSold	State variable that maintains a count of the total number of tokens sold during the campaign.
spendingLimit	State variable that represents the maximum amount of funds that the campaign aims to raise. And we have set as an example 100 ethers.

To manage individual token balances, we created a mapping called *balances*. This mapping associates each investor's address with their corresponding token balance. By using this mapping, the contract can keep track of how many tokens each investor holds.

Then the event called *FundRaised* is emitted whenever funds are raised in the campaign. It includes three parameters: the address of the investor who contributed the funds, the amount of funds raised, and the number of tokens issued to the investor. This event can be used to track and log the fundraising.

Name	Type	Definition
OnlyClub()	Modifier	Used to restrict the invocation of certain functions to be accessible only by the club associated with the contract. More specifically, it ensures that the withdrawFunds operation can only be performed by de club.
Constructor()	Constructor Function	Executed once during the contract deployment. The constructor sets the club address to be the address of the account or entity who deploys the contract. This establishes the club as the owner of the contract.
buyTokens()	Function	Allows users to purchase tokens by sending ether to the contract. Users need to provide a valid amount of ether that is greater than zero, indicating the funds they wish to contribute. The function verifies that the total funds raised, when combined with the amount sent, does not exceed the spending limit defined by the contract. If the conditions are met, the function calculates the number of tokens to issue based on the amount of funds received, for example we have put that the number of tokens are the same as the funds received. It then updates the sender's token balance, as well as the total funds raised, and total tokens sold variables. Finally, it emits the *FundRaised* event, providing details of the transaction.

withdrawFunds()	Function	With this funcion the club can withdraw funds from the contract. It requires the club to specify the amount of funds they want to withdraw. The function validates that the requested amount is valid (greater than zero) and does not exceed the contract's current balance. If the conditions are met, the function deducts the withdrawn amount from the total funds raised variable and transfers the specified amount of ether to the club's address. This allows the club to access the funds raised during the campaign.

In summary, we created a contract that provides the necessary infrastructure to facilitate the fundraising campaign. It allows users to contribute funds and receive tokens in return, while ensuring the club can manage and withdraw the raised funds within the defined limits.

Test

We have also created a test python file which uses the *pytest* framework to test the functionality of the previously mentioned contract. We have provided a breakdown of what the test file does:

The *test_fund_raising_contract()* function represents a test case. It starts by deploying an instance of the *FundRaisingContract.sol* smart contract using the *FundRaisingContract.deploy()* method. The contract is deployed from the first account in the accounts array which means that the account[0] is the club.

The initial state of the contract is then checked using assertions. It verifies that the initial total funds raised, and total tokens sold are both zero. Next, the test simulates buying tokens and raising funds by calling the *buyTokens()* function of the contract twice. Each call is made from different accounts (accounts[1] and accounts[2]) with a specific value of ether attached to it (1 ether and 2 ethers, respectively).

After the token purchase, the test checks the token balances of the two accounts using assertions. It ensures that the balances match the amounts of ether that were used to buy the tokens. Then verifies the updated state of the contract. It checks that the total funds raised, and total tokens sold have increased accordingly, reflecting the contributions made by the accounts.

To test the withdrawal functionality, we call the *withdrawFunds()* function of the contract. It attempts to withdraw 2 ethers from the contract balance, specifying the first account (accounts[0]) as the recipient of the funds because it is the club one.

After the withdrawal, the test verifies that the remaining balance in the contract is correct by checking the updated total funds raised using an assertion.

Finally, we check the behavior of the contract when attempting to withdraw more funds than are available. We use the reverts context manager from the Brownie library to assert that the *withdrawFunds()* function, when called with an amount of 2 ethers, reverts with the error message "Insufficient balance".

In summary, the test case covers various aspects of the fund-raising contract, including deploying the contract, buying tokens, checking balances, withdrawing funds, and handling insufficient balance scenarios. It helps us to ensure that the contract functions as intended and adheres to the expected behavior.

CONCLUSIONS

In conclusion, we are satisfied with our project and how much we have learned along the way. It pushed us to do extensive research and think outside the box. We also faced our fears head-on when it came to coding in Solidity. It was intimidating at first, but by working together and doing some extra research, we managed to write functional code that we are proud of. It might not be perfect, but it gets the job done and fulfills our goals.

We believe this project is highly useful and holds immense potential for future development. The implemented applications have already proven their worth by improving operational efficiency and financial stability for Football Club Barcelona. As technology advances and blockchain adoption grows, there are ample opportunities to enhance transparency, fan engagement, and explore additional use cases within the club. By leveraging blockchain's benefits, the club can continue to innovate, provide a better experience for fans, and unlock new growth opportunities.

We want to give a big shoutout to our professors who have helped us everytime that we have needed it and supported us along the project.

Overall, we have gained a deeper understanding of the subject matter and have become more confident in our coding abilities. We are proud of what we've achieved and grateful for the chance to learn and grow through this subject.

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