

Louvain School of Management

Study on digital ownership in the gaming industry and analysis of a possible new approach via the implementation of blockchain and non-fungible tokens.

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Reader Warning:

The term gaming used in this master's thesis refers to the video game and therefore covers the same reality.

Definition of "video game": "A game played by electronically manipulating images produced by a computer program on a television screen or other display screen."

Source: Oxford English Dictionary

Lexicon

1. S.E.L.L : Syndicat des éditeurs de logiciels de loisirs
2. I.S.F.E : Interactive Software Federation of Europe
3. Esport : Electronic sports
4. MMO : Massively multiplayer online
5. F2P : Free-to-play
6. P2P : Pay-to-Play
7. DLC : Downloadable content
8. FUT : FIFA Ultimate Team
9. PC : Personnel computer
10. GOG : Good Old Games
11. POS : Proof of stake
12. POW : Proff of work
13. IP : Internet protocol
14. ERC : Ethereum Request for Comments
15. IPFS : InterPlanetary File System
16. CEO : Chief executive officer
17. Sig. : Sigma
18. Cs :go : Counter-Strike: Global Offensive
19. WoW : World of Warcraft
20. UFO : Unidentified flying object
21. AXS : Axie Infinity
22. SLP : Smooth Love Potion
23. ETH : Ethereum
24. VR : Virtual reality
25. AR : Augmented reality

1. Introduction

"The nature of these digital transactions is extremely unbalanced in favor of platforms and against users, turning owners into licensees." (Perzanowski, Aaron, Jason Schultz, 2017)

The emergence of the internet has had a huge impact on our relationship with goods. Indeed, the internet has allowed us to have easier access to a wide variety of entertaining content such as music, movies, books and various applications. Books, CD's, DVD's and video games have left our shelves and libraries to be stored online and accessed via an internet connection.

Books, cloud storage, streaming, and other digital goods offer users convenience and flexibility but at what cost? While in the past you could take your goods home, lend them to a friend, or resell them, since the digitalization of our goods, this is no longer possible. Some would even say that we are no longer the owners of our goods but instead we just have a license and that they can be taken away at any time.

This has led to changes in copyright and the implementation of digital rights management by businesses. Indeed, the rise of cloud computing has changed the way we think about digital property and, in many areas, has raised questions about ownership and control of that content.

The gaming industry, which has been continuously expanding for the past 20 years, is no exception to the rule. Indeed, physical games are being replaced by digital games and the economic model of most games has totally changed, forgetting little by little the classic pay-to-play model which provided the entire game upon purchase. In recent years, however, there has been a shift towards digital distribution of games his has allowed for a variety of different pricing models to emerge, such as free-to-play games that are supported by in-game microtransactions, or subscription-based models where players pay a regular fee to access a large library of games. Digital ownership has become a growing concern in the video game industry due to the shift to digital distribution of games and in-game purchases.

Meanwhile, new technologies are emerging such as blockchain. First introduced in 2008, its primary purpose was to enable the creation of secure, transparent and immutable records of transactions. The use of blockchain has also been driven by the growing demand for digital services and the need for secure and efficient ways to manage and transfer data and assets online. It has the potential to disrupt and transform a wide range of industries and is expected to continue to be an important area of innovation and development in the years to come.

Thus, to respond to the problem of digital ownership, some precursors have undertaken the mission of bringing digital ownership to users. This is how, using blockchain technology, the Ethereum network was born, leading to the appearance of non-fungible tokens. NFTs were created to solve the problem of ownership and authenticity in the digital domain. Overall, NFTs were created as a way to ensure ownership, authenticity and rarity of digital objects, and to allow creators and collectors to monetize and exchange these objects in a new and innovative way.

Gamers around the world are spending more and more time and money on video games. Indeed, studies have shown that there are more than 3.2 billion gamers worldwide and that the global market is worth more than 300 billion dollars. It seemed important to me to analyze how these players were dealing with their digital property. In addition, the NFT market is growing worldwide.

Therefore, this thesis aims to analyze the impact that blockchain via NFTs can have on digital ownership in the gaming industry. First, a study on the opinion of gamers concerning their digital property of their digital video games but also on their digital items in those games after purchasing in-game items was done. The study is structured as exploratory. Indeed, the first goal is to better understand the players' temperature on shifting to digital games and their digital goods. Through a questionnaire conducted for this study, data was collected on 459 players. This allowed me to better understand players' views on digital property. Following this, a more in-depth analysis of how blockchain via NFTs can benefit or hurt gamers and developers and adapt or not to the new business model of game companies.

This first part is to set up my theoretical framework and to see how the video game industry has evolved in the last few years to then explain how blockchain and NFTs work. Then we will analyze the results obtained from the questionnaires proposed to the players in order to confront the results with what we developed. Also, we will analyze how blockchain via NFTs can bring a new approach and be implemented in the video game industry. Last but not least, we will analyze some projects that have already embarked on the adventure and we will depict the business plan that they have decided to follow.

2. Literature review

2.1 The gaming industry and its evolution

2.1.1 The newborn of the cultural industry.

"The video game has, since its beginnings, illustrated itself as a true vector of innovation, as well as an evangelizer of new technologies" (Cité science et industrie).

This new relationship between new technologies and the video game industry will become one of the main reasons for the development of the electronic and computer industry, which will push the search for increasing performance of software, new hardware and new means of telecommunications networks.

"The video game has the property to spread, to impregnate and inspire all economic activities, cultural practices and social uses. Without a doubt, the video game industry is massive, powerful, technical, global and conquering. It invents and feeds on the variety of economic models and forms of monetization of digital services. It follows the contours of a complex, evolving and heterogeneous globalization" (Pierre-Jean Benghozi, Philippe Chantepie, 2017).

The video game industry took advantage of being halfway between culture and technology to take the best of both industries and be the sector that is one of the few cultural industries with strong growth. In fact, thanks to its close link with the economic and technological economy, the industry has succeeded in reaching an international public, in massifying its market and thus avoiding the path often taken by the cultural industries. Moreover, while previously the video game was limited to consoles specifically dedicated to it and to computers, the sector has succeeded in taking advantage of technological advances to become more and more involved in supports not strictly dedicated to the video game used in everyday life such as smartphones, televisions,

tablets, etc... This banalization allowed to reach all age groups and all genres that were not particularly technophile or interested enough to invest in the video game. To succeed in adapting to this new market, the video game industry has succeeded in turning its economic model and its forms of monetization of video games to suit all audiences. Today, the sector reaches approximately 1/3 of the world's population (DFC Intelligence, 2022) and although widening it is the latest cultural industry, it has only taken a few years to become one of the most powerful cultural and it is not ready to stop there.

2.1.2 A never-ending growth

At the beginning of the 90's, although after a crisis that the sector experienced in the 80's and which resulted in the closure of many companies and a significant drop in revenue (blanchet 2010) industry revenues continue to grow (Appendix 9.1). While the video game industry only began in the 1970s, by 2020 it has overtaken the music and film industries combined (Beattie, Andrew. 2021).

It is very complicated to have accurate statistics about the international video game industry. One of the main reasons is that the segments of this sector do not cease widening, indeed as explained previously the sector is not limited any more to home consoles and arcade terminals. Between "the manufacture of computers and peripherals", "the manufacture of consoles and their peripherals", "software publishers", "physical software", "dematerialized software", "network software", "online software", "film production", "download software", "soundtracks", "esports", "streaming" and many other points to consider, it is getting very complex to know how much exactly is the market share of this industry. Nevertheless, there are organizations and institutions that allow us to get closer to these figures and to have an overview of them.

According to a study conducted in September 2021(Nolan, Robert. 2021) by DFC intelligence who is a Leading Provider of Industry Analysis and Market Forecasting for the Video Game Sector, there are approximately 3.115 billion gamers worldwide 45.4% in Asia, 21.4% in Europe, 12.2% in Latin America, 8.3% in North America, 5.1% in the middle east and north Africa, 4.3% in sub-Saharan Africa and 1.1% in Oceania. (Appendix 9.2)

According to a study conducted by Idc and Accenture (2021), the global gaming industry is worth \$300 billion in terms of direct and indirect revenues (Appendix 9.3). Mobile games alone contribute more than \$100 billion in direct revenue to the industry. The mobile gaming sector, which exploded with the arrival of smartphones, is taking an increasingly important part in the gaming industry (Appendix 9.4). Democratization of game development is being enabled through open platforms like App Store and Google Play that enable every smartphone owner to have a console in their pocket. It's an exciting time to enter the space, in fact we're seeing 174 Games reaching \$100M annual grossing last year, that's more than twice the number of Hollywood box offices last year (Appendix 9.5).

"Video gaming continues to progress to new heights. The year 2020 was extraordinary, but unusual because of the context. This growth confirmed in 2021 is a real underlying trend. The French have never played so much. 73% of them play occasionally and 58% regularly, an increase of 6 points compared to 2020," (Julie Chalmette, President of SELL, 2022).

The Syndicate of leisure software publishers (SELL) which is a French trade union and which aims to promote the interests of video game publishers that almost every year proposes an assessment of the French market. In addition, The Interactive Software Federation of Europe (ISFE) who is an independent federation, representing the interests of the video game industry in Europe to the main stakeholders: EU institutions, international organizations, academics, or the general public with the help of The European Games Developer Federation and also propose an overview of the video game sector in Europe.

We notice that in Europe, the gaming turnover reached 23.3bn euros in 2020 and is an increase of 22% compared to the previous year, 40% of which comes from online revenues, 40% from the mobile sector and 20% from the physical sector. The number of hours spent playing video games is on average 9.5 hours per week in 2020, which represents an increase of 9.5% compared to 2019. Moreover, 50% of the population aged between 6-64 years old play video games and the average age is 31.3 years old, 47% of which are women. (ISFE. 2021)

The revenue associated with eSports is also evolving significantly. Esports means "electronic sports" and involves an alternative way of playing sports assisted by electronic systems and mediated by human-computer interfaces (Hamari and Sjöblom, 2017). According to Deloitte (Appendix 9.6) The number of investments in esports doubled in 2018, from 34 in 2017 to 68 in 2018. This is also reflected in the total dollars invested: Investments increased to \$4.5 billion in 2018, up from just \$490 million the year before, a staggering annual growth rate of 837%. These investments are distributed to players in the ecosystem - from esports organizations to tournament operators to digital broadcasters - allowing it to operate and grow. The esports worth 1 billion and has an estimated 437 million viewers, occasional and esports enthusiast. In 2019, 885 major events took place. Together, they generated \$56.3 million in ticket revenue, up from \$54.7 million in 2018. Total prize money in 2019 was \$167.4 million, up slightly from \$150.8 million in 2018. (Newzoo, 2021)

It is interesting to note that from 2015 to 2020, digital revenue in Europe has increased by 31% compared to 2019. 64% of digital revenue comes from in-game extras, additional downloadable content for games already bought, 11% from subscription gaming and social gaming and 25% from full games downloaded (ISFE, 2021). In the same line, in 2021 the gaming market turnover represents 5.65 billion euros in France and 1.8 billion come from additional content, 1.2 billion from streaming and on-demand services and 0.23 billion from subscription/services (S.E.L.L, 2022). The industry is becoming more and more digital.

2.1.3 The business model also follows the evolution

It's not only the hardware that has evolved with the new technologies and digital advances but also the business models that publishers propose for their games. While in the early days of the gaming industry it was mostly about the so-called arcade model where usually a certain price is offered for a certain number of lives or time and the goal is to go as far as possible or to have the highest score. As well as a premium/pay-to-play model which is the classic model where the consumer pays for access to the full game of a physical product or an extension that increases the life of the game. At the beginning of the 2000's with the rise of the internet, massively multiplayer online role-playing games appeared with a subscription system that allowed access to the game in exchange for a

certain price to be paid for a certain period of time (month/quarter/year). Other MMOs turned to freemium models where the access to the game is free at the beginning of it but which nevertheless limits its content without payment from the user (Zendle, David, Rachel Meyer, and Nick Ballou, 2020).

As innovations continue to develop, publishers are moving more and more towards a business model known as free-to-play, which is a free online game to download. It is often financed through microtransactions (cosmetics, resources, lives, characters), advertisements or product placements. As of June 2016, F2P revenues totaled roughly USD 17.1 billion worldwide, whereas P2P revenues were approximately USD 2.8 billion (Clairfield, 2018). To compensate, many pay-to-play games will integrate free-to-play codes such as loot boxes and micro-transactions via in-game purchases or battle passes directly within the game that allow for in-game advantages or purely cosmetic items (Zendle, David, Rachel Meyer, and Nick Ballou, 2020)

2.1.4 Loot box and micro-transaction the new royal couple

If we look at the evolution of the price of a standard video game since the 70's, we can see that the price of this one has hardly changed and even more if we take inflation into account, it decreases over the years (Appendix 9.7). There are very few businesses whose prices have remained practically identical for 30 years. However, it's not as if the players are getting less for their money, if we compare the old games and the new ones, there is a clear progression in terms of life span, online content, graphics, innovative gameplay, updates, story and soundtrack, etc. In addition, the author and video game designer Raph Koster published a study (Koster, Raph, 2018) in 2018 that shows that the costs of producing triple-A games, those with the largest production and promotion budgets, have increased dramatically over the years (Appendix 9.8).

So as video games became more and more ambitious and expensive to produce, publishers, shareholders and developers needed to find other ways to earn back their investment and turn a profit. So, at the turn of millennium, downloadable content, map packs and expansions became popular which was perfect for them because these things were much more faster and easier to develop than a whole new game. In the generation of ps3, wii and xbox 360 most AAA titles had some kind of dlc. The Xbox had an avatar

outfit, a paid wallpaper and we also saw an increase in collectors and special editions as well as a change in the subscription model via season passes. Companies are constantly trying to find the most effective way to monetize their game without directly raising the price.

But all this was only the beginning of a new way of monetization, although the Dlc and season pass were working well it was necessary to find a new way to bring in even more money. The marketing department of the video game companies still had a lot to do and it all started in April 2006 when Bethesda announced its famous "Horse Armor Pack"(Bethesda, 2006) for The Elder Scrolls IV: Oblivion. Problem, it only contains two poor armors to pimp his horse in the Tamriel fashion. A scandal broke out and many players complained that it was far too expensive. Yet it ranked among the best-selling DLCs by Bethesda (McElroy, Griffin.,2009). "We're not going to make any rash decisions, as the Horse Armor Pack has been available for just five hours. We'll see what people think of it and release the few other additional content items we have planned, then decide where we go from there. Some people seem to be excited about it and are already using it, others don't want it. Maybe the latter will prefer Orrery or Wizard's Tower. We'll see when they come out and use the feedback to determine what we release, how much, etc" (Pete Hines, vice president of marketing at Bethesda.)

Although this was the first attempt at micro-transaction by Bethesda. It is with the game FIFA 09 in 2009 that the micro-transaction will change the game. It was one of the first pay-to-win video games on console. Fifa ultimate team mode was a dream come true for the shareholders.

"It is a competitive game mode, where players build and manage their own team, before moving into one-on-one and two-on-two ranked games. FIFA Ultimate Team (or FUT) is an entirely different world from the "classic" FIFA experience, it is a much more complete, challenging and extremely competitive mode. But it's attracting more and more people every year, drawn by its complexity, depth and rewarding nature. FUT is based on the acquisition and sale of players, who are accumulated through packs that can be obtained by completing objectives, or by putting money in your pocket"(L'internaute). Football being the most popular sport in the world, FIFA was one of the most played games in the world (ISFE). The fifa ultimate team mode allowed you to assemble and collect cards representing players from all over the world and this via the purchase of

pack in card via the currency earned in the game (limited) or via your wallet and it is logical that the more packs you open the more chances you have to have better cards and therefore better players in your team. EA, the developers of FIFA, didn't just implement it in FIFA also integrated this system to their game NBA 2K and MADDEN (American football). This system can be compared to gambling and can lead some players, sometimes underage, to spend hundreds or thousands of euros in the game. (King, Daniel L, and Paul H Delfabbro, 2020)

EA market capitalization went from \$5.14Billions in 2008 to \$35.08Billions in 2022. and they went from 3.5\$billions revenue in 2008 to 6.551\$billions in 2021(Appendix 9.9). Knowing that in the EA revenue report of 2021 they state that 29% of their revenue comes from ultimate team across FIFA and other games developed by EA where the ULTIMATE team game mode is available for the year 2021. So, we can estimate that ultimate team brought in 1.9\$billions for the fiscal year 2021. (Electronic Arts inc., 2021)

Seeing the success and money that ultimate team brings, many publishers have followed the same business model and introduced a micro-transaction system within their game. Activision Blizzard, another major video game company, reported more than USD 1.2 billion in revenue from in-game purchases between July and September 2020(Activision Blizzard, 2020). If we look at the list of the most played games for the moment, 90% of them contain in-game purchases (Newzoo, 2022). According to the business research company the global online microtransaction market size is expected to grow from \$59.49 billion in 2021 to \$67.60 billion in 2022 at a compound annual growth rate of 13.6%. According to a study conducted by Topdollars, the average MMO player spends \$219 on in-game purchases (Mikaela Sullivan, 2020) and 89.4% of them responded that they had spent money in-game.

2.1.5 Ownership in a digital industry

We are in 2005, Jimmy invites his best friend at home to show him his collection of video games. Well arranged in a shelf we can see a collection of games GameCube, Ps2 or Xbox. Jimmy wants to be sure that they are in perfect condition, some have not even been unwrapped from their plastic film. With each use he is careful not to scratch the disc or damage the box of his games. 15 years later Jimmy shares his passion for video games with his son and shows him his collection. His son does the same but no shelves, no boxes or physical consoles. His son has more than 100 games through several online accounts

on steam, the PS store and the Xbox store. He is proud of his collection and also of the skins and items he has accumulated on games such as League of legends, cs:go or even Fortnite. His father doesn't understand because for him his son doesn't own anything unlike him because all these games are intangible and can disappear at any time but his son doesn't agree and an argument breaks out. But what is it really?

First of all, we will ask ourselves the question if, although the goods are not physical, it is possible to feel the ownership of them. The answer is yes, we are talking about psychological ownership.

Pierce, Kostova, and Dirks explain that Psychological ownership refers to feelings of possession that can arise even in the absence of legal ownership. Moreover, Consumers develop feelings of ownership for target objects when they invest themselves (Kamleitner & Erki, 2013), control (Peck, Barger, & Webb, 2013), or develop intimate knowledge of a target (Kirk, Peck, & Swain, 2018). Therefore, a gamer who spends several hours a week playing games and investing money in either games or virtual goods is bound to feel ownership of his or her digital goods as well as the virtual-item collection. Moreover, Wee-KhengTan & Chieh-YuYang explain that psychological ownership positively influences the perceived enjoyment of the game. The more a player will accumulate digital goods the more his feeling of ownership will increase but is this feeling legitimate at the legal level of possession?

2.1.6 A service for a good

According to SELL figures, 82% of the French market is dematerialized (console + PC + mobile). But while the dematerialized market is becoming more and more important, a question arises: do we own the digital games we buy? The answer from Chang, Jenny is simple: No in most cases. Indeed, if we look at the steam subscriber agreement: "the Content and Services are licensed, not sold. Your license confers no title or ownership in the Content and Services" (Steam, 2022). In EA's terms of use for Origin it says "The EA Services are licensed to you, not sold. EA grants you a personal, limited, non-transferable, revocable and non-exclusive license to use the EA Services to which you have access for your non-commercial use, subject to your compliance with this Agreement (Arts, Electronic, 2021).

Therefore, unlike physical games, you can't resell, lend or trade them to a friend or others for FIAT money. It is the same for platforms such as epic store or origins. Unlike humble (not always) or GoG which offers an explicit DRM (=digital rights management)-free policy. The same goes for micro-transactions available in games such as fortnite, cs:go , league of legends , FIFA , etc. Platforms such as steam, rocket league or FIFA allow to exchange, sell our skins or digital assets but only for their "currency" it is impossible to take the money out of the internal system without going through third party sites unregulated which can involve risks of fraud and scam and on paper, moreover it is against their policy to sell digital assets outside these games. They have the right to shut down your account or sue for legal damages (Steam, 2022) (Electronic Arts, 2021).

“people find themselves paying a few euros that can easily turn into hundreds of euros in game or microtransaction to stay competitive in a game or simply for cosmetic purposes. They take the risk that the servers close and see their in-game purchases evaporate/modify with all the money spent to acquire it. It is a service that we pay for and not a good “Group, HCI Games (2018).

2.2 Explanation of the blockchain and its components

2.2.1 The new technological revolution?

Since the advent of cryptocurrencies, blockchain is a term that we hear more and more around us (Google trend). However, even though it is being talked about more frequently, it is still a subject that has a lack of understanding and awareness on the part of the general public. There are several ways to define blockchain depending on how you approach it. Lauren Leloup proposes one:

"A blockchain is a distributed transactional database, comparable to a decentralized and shared accounting ledger, which stores and transfers value or data via the internet, transparently, securely, and autonomously because it has no central controlling body. This ledger is active, chronological, distributed, verifiable and protected against falsification by a system of distributed trust (consensus) between the members or

participants (nodes). Each member of the network has an up-to-date copy of the ledger (in near-real time) and the content is always in phase with all the participants (Peer-to-peer network)"

Thus, the blockchain allows the automation of the transaction by removing the third parties, is a system of distributed consensus and shared trust and is an infrastructure of certification and notarization.

According to Laurent Leloup the principles on which the blockchain is based are

- The distributed ledger: similar to an accounting ledger, it contains all transactions and is accessible by all participants
- Decentralization and disintermediation: there is no need to go through a trusted third party who controls the blockchain in order to perform a transaction
- Consensus: a transaction is carried out and therefore accepted or rejected following a distributed consensus. There are several types of consensus
- Immutability: It is impossible to modify or delete entries
- Shared trust and transparency: All data, operations and consensus are shared and accessible

2.2.2 Blockchain, how does it work?

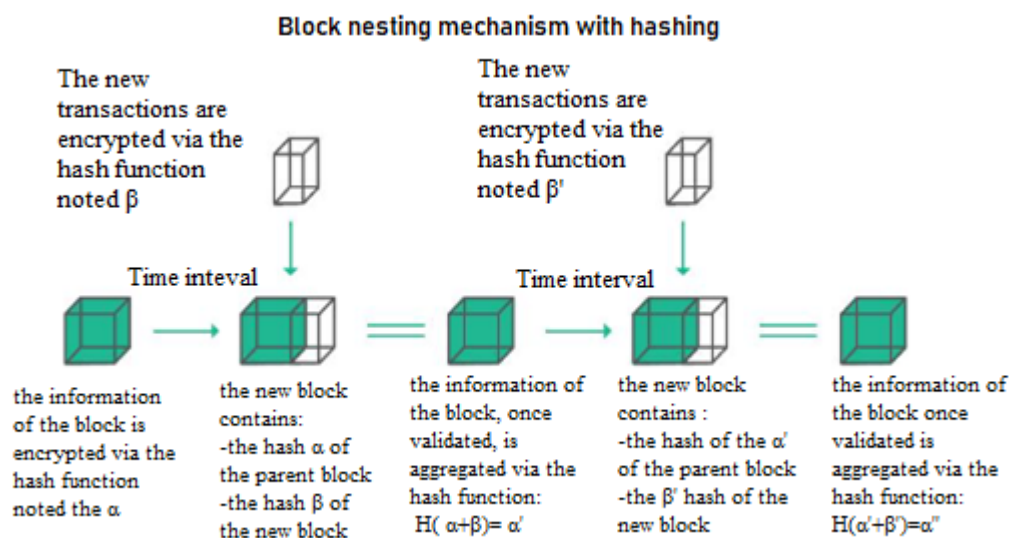
Today, imagine that you want to transfer money to someone, how does it happen? Either you make an electronic transfer and the money goes from you to the bank and then when the bank confirms the transfer it is sent to the other person. Another solution would be to give the money directly to the person in cash but for that you have to go to the bank to withdraw the money so you also depend on this trusted third party and even if the cash is in your possession it is only because the bills have a "serial number" that it is accepted and it is the central bank that itself controls its bills. And so, in 2008 a certain person or group by the name of "Satoshi Nakamoto" created bitcoin with the aim of removing the need for a third party. In order to achieve his goal "Satoshi" used the "blockchain".

Let's take a group of people who don't want to rely on banks anymore. Everyone knows how much money each person has but doesn't know their identity instead they will have numbers. Each person has access to a block sheet and is prepared to record each

transaction. So, when someone wants to make a transaction to another person, all the other members of the group will first check that they have the money they want to transfer, then each person will write on the blank page the date, time and information of the transaction with the number of the person sending the money and the person receiving it. We continue this until the block sheet is filled to the maximum and we seal the sheet with a key that everyone has agreed on and we "archive" this blank page indefinitely and take a new one. While before it was the role of the bank to verify that the document remains unchanged, it is now the role of all users of the Group. In our example here, each person represents a node, the set of people is the peer-to-peer architecture and the block sheet represents a block and the whole represents the blockchain.

2.2.3 How to seal the block?

To have trust in this currency and to make it unfalsifiable, blockchain technology proposes an ingenious articulation of two concepts: the hash function and the peer-to-peer distributed ledger (Tequi, Clément, François Hiault, and Martin Della Chiesa, 2019). The hash function is a cryptographic function that allows to transform digital input data into a unique output. We always find the same output with an input but it is almost impossible to find the input using the output given the current state of our computing power which the only way is to try again and again until we find the right input. So, each block that we find in the blockchain is made of a chain of hashes that link each block each other from the first block (Genesis block) (Sayeed, Sarwar, and Hector Marco-Gisbert, 2019)



This hash function allows the immutability of the blockchain, indeed if someone with malicious intentions wants to change an information in the blockchain in order to modify transactions, it will generate a modification of the hash and thus modify all the hashes of the blocks since they are linked together. Each person and therefore node of the peer-to-peer network holding a copy of the blockchain, this modification will be directly detected and rejected by all the nodes of the network. (Tequi, Clément, François Hiault, and Martin Della Chiesa, 2019) These two concepts will work together to ensure the security of the blockchain except in case of an attack by the 51% (Sayeed, Sarwar, and Hector Marco-Gisbert, 2019).

2.2.4 Different types of consensus.

2.2.4.1 Proof of work

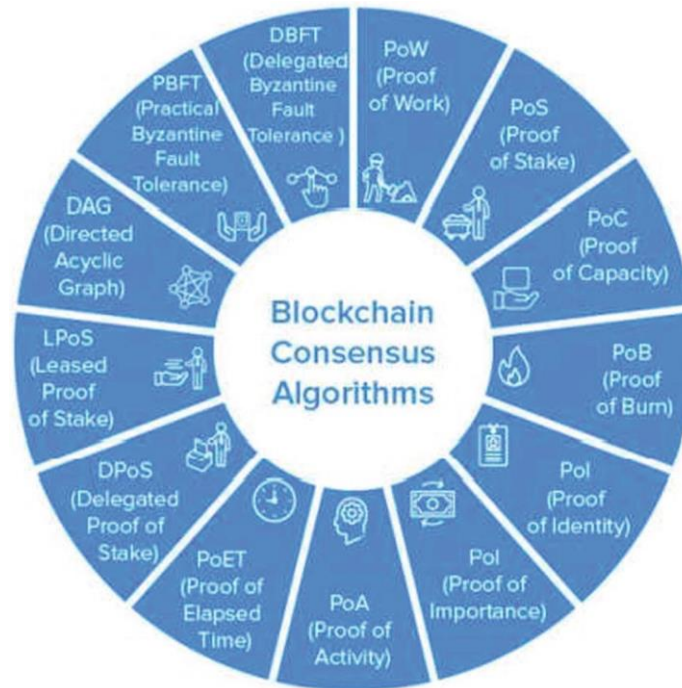
Satoshi Nakamoto explain that in order to create the next block that we are going to name i : we are going to need the hash code of the block $i-1$, then we insert the desired data, we add the signature in order to say who created the new block, we add a proof of work and we finish by inserting the hash of block i

The proof of work represents a calculation that must increase the difficulty of the next hash to be found in order to avoid that several blocks are created at the same time and thus compromise the whole architecture and avoid malicious uses or attacks. For example, the system will force the hash of the block to begin with a certain number of 0's, which will exponentially increase the difficulty. The difficulty changes every 2016 blocks. The network adjusts the difficulty so that the generation time of these 2016 blocks is 14 days, regardless of the computing power deployed. "Therefore, the difficulty follows the power of the network. The adjustment algorithm is as follows: if the measured time in the 2016 blocks period is less than 20,160 minutes (expected time), then the difficulty increases to conform to the assumed computational power; if it is greater, then the difficulty decreases. The rewiring is limited to a factor of 4 (multiplication as well as division) to avoid instabilities." (Bitcoin.fr) Solving this kind of problem requires a certain amount of computing power, so to encourage people to do this work when the block is validated, the one or the group who have solved the mathematical problem receive a reward in bitcoin (Satoshi Nakamoto 2008).

2.2.4.2 Proof of stake

There are many other types of consensus such as the proof of stake used by Ethereum the second most popular cryptocurrency after bitcoin which previously used the proof of work consensus. In the Ethereum whitepaper Vitalik Buterin explain that PoS (proof of stake) aims to achieve the same result as the proof of work and was first thought to solve the energy problem that the proof of work can have because it uses a lot of energy to perform its calculations. In May 2022, this number exceeded 112 TWh, and exceeds the annual consumption of the Netherlands. (Selectra, 2021)

The proof of stake validators dedicates their cryptocurrency to securely verify transactions on the network. Indeed, to have a chance to verify the transactions of a block and thus to receive the associated reward the validators must put in play a minimum number of this cryptomoney (Vitalik Buterin, 2013). Therefore, if one of the validators tries to attack the network, he will suffer a penalty. Pos follows an internally game-theory approach because a person would lose more money attacking the network than following the rules of the game. This approach is less prone to 51% attack (Sayeed, Sarwar, and Hector Marco-Gisbert, 2019) and is more decentralized. It is also energy efficient as no complex computations are involved. The major issue is that there is a possibility of power concentration among some miners (Lee, Seok-Won, Irish Singh, and Masoud Mohammadian, 2021). There are still many others consensus and there could be an infinite number, here is a non-exhaustive list:



George, J.T. (2022). Consensus Algorithms for Blockchains. In: Introducing Blockchain Applications.

2.2.5 Different types of blockchains

Although historically the goal of the blockchain was to remain public and therefore accessible to all, slowly came the idea of a semi-private blockchain or even totally private. Indeed, some companies or even financial intuitions have more interest in opting for a blockchain called consortium or even private.

2.2.5.1 Public blockchain

The main interest of the public blockchain is that it is accessible to everyone, anyone can use it and participate in the consensus process. It is secured by a concept of cryptoeconomics that brings together the fields of economics and computer science by combining cryptography with economic incentives (MIT management sloan school). Each actor can have an influence equal to the resources it brings to solve cryptographic mechanisms that follow a certain consensus such as PoW or PoS. It is considered as totally decentralized (Leloup, Laurent, 2017) (Gayvoronskaya, Tatiana, and Christoph Meinel, 2021).

2.2.5.2 Consortium blockchain

Here the principle is a blockchain where the consensus process is validated by pre-selected nodes. Access to the register can be public or restricted. For example, financial institutions or each of them represent a node and only 2/3 of them have to sign the block for it to be validated. This can be useful for a group of companies that want to work together without a trusted third party but need to control and/or private transactions. (Leloup, Laurent, 2017) (Gayvoronskaya, Tatiana, and Christoph Meinel, 2021).

2.2.5.3 Private blockchain

It is a blockchain where the authorization to write is totally centralized to one organization. It can be several organizations that trust a third person. The access to the reading can still be public or restricted.

It is true that the consortium or private blockchain has several significant advantages compared to the public one. In case of error for example it is possible to go back or modify a transaction. The validators are known and therefore we are less susceptible to attack 51%. Transactions are less expensive because the network is smaller while public blockchains have generally higher transaction fees. Consensus is validated more quickly and finally it offers privatization. Although there are several advantages to a private blockchain, we lose the philosophical essence of the creation of this technology which was neutrality, freedom and openness and therefore its decentralization. (Leloup, Laurent, 2017) (Gayvoronskaya, Tatiana, and Christoph Meinel, 2021).

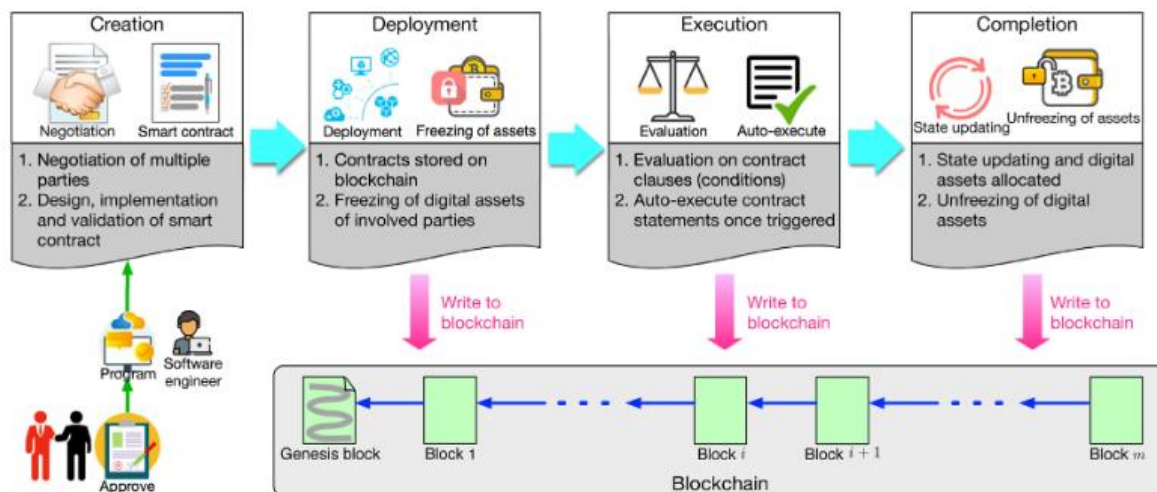
2.2.6 Ethereum

Ethereum is a decentralized platform proposed by Vitalik Buterin in 2013 and released in 2015(Ethereum.org) It is the most important blockchain after bitcoin. Unlike bitcoin, which is dedicated to managing monetary applications. The Ethereum aims to create a decentralized web. The two most important characteristics of Ethereum is that it will allow the implementation of smart contracts and the possibility of creating decentralized applications.

2.2.6.1 Smart contract

The idea of smart contract dates back to long before the appearance of blockchain. In 1996 a certain Nick Szabo had already had the idea of a contract that would be automatic and secure on a public network as a computerized transaction protocol that executes the contractual terms of an agreement (Szabo, Nick, 1996).

The contract is here totally digital, autonomous, automatic and is registered in the blockchain and thus follows the principles of the blockchain. Therefore, the contract is immutable, public and decentralized (Zou, Weiqin, David Lo, Pavneet Singh Kochhar, Xuan-Bach Dinh Le, Xin Xia, Yang Feng, Zhenyu Chen, and Baowen Xu, 2021). For example, when buying a house, the smart contract makes it possible to avoid the use of a notary, a bank or a trusted third party.



Zheng, Zibin, Shaoan Xie, Hong-Ning Dai, Weili Chen, Xiangping Chen, Jian Weng, et Muhammad Imran. « An Overview on Smart Contracts: Challenges, Advances and Platforms ». *Future Generation Computer Systems* 105 (1 April 2020): 475-91. <https://doi.org/10.1016/j.future.2019.12.019>.

Smart contracts are also very useful for the purchase of dematerialized goods because it will ensure that you receive the digital good in exchange for the fulfillment of certain conditions.

2.2.6.2 Decentralized application

Unlike a centralized application that uses a third-party server. According to Andreas Antonopoulos A decentralized application is an application that is totally or partially decentralized including:

- One or more autonomous contracts (smart contracts) that run on a blockchain (or even several).
- A transparent user interface.
- A distributed data storage model.
- A peer-to-peer message communication protocol.
- A decentralized name resolution system.

Not all these conditions are necessary to have a decentralized application

2.3 Non-fungible token

Investopedia define fungibility by "the ability of a good or asset to be interchanged with other individual goods or assets of the same type". Fungible assets simplify the exchange and trade processes, as fungibility implies equal value between the assets".

Today there are already non-fungible objects all around you. Indeed, by definition, the objects that surround you, such as the clothes you wear, your car, a plane ticket, a cinema ticket, certain digital objects in video games or a work of art such as the Mona Lisa, can be non-fungible or semi-fungible objects. The fungibility can be something subjective and relative, for example a seat near the windows in a plane can be more expensive for some than a seat on the aisle and your sweater can be replaced by another of the same brand that it would not change anything for you unless you have developed an attachment to this sweater. This is called semi-fungibility. NTFs brings the notion of "token" to the table. A token that is fungible is a token that can be interchanged with any other token of the same type. For example, the very first bitcoin mined can be exchanged with the very last or any other and these will be equivalent and indistinguishable.

A non-fungible token is a non-interchangeable token that represents and is linked to an often-digital object whose owner can be easily identified through the blockchain. NFT was firstly proposed in Ethereum blockchain (Ethereum.org) (EIP-721) and it is derived by smart contracts of Ethereum. NFTs can be used in all types of domains such as art (Franceschet, M., Colavizza, G., Smith, T.), music (Shilina, Sasha, 2021), video games (Cryoptokitties), events(Regner, Ferdinand, André Schweizer, and Nils Urbach, 2019) or

even real estate(Zadra-Veil, Cathy, Valentin Blanc, Erika Dewald, Marc Durand, Benjamin Fragny, Youness Garah, Lolita Gillet, 2021).

“Furthermore, the creator can also earn royalties each time of a successful trade on any NFT market or by peer-to-peer exchanging. Full-history tradability, deep liquidity, and convenient interoperability enable NFT to become a promising intellectual property (IP)-protection solution. Although, in essence, NFTs represent little more than code, but the codes to a buyer have ascribed value when considering its comparative scarcity as a digital object. It well secures selling prices of these IP-related products that may have seemed unthinkable for non-fungible virtual assets.” Qin Wang, Rujia L , Qi Wang, Shipping,Chen (2021).

Although Ethereum is the most known blockchain for NFTs there are others such as Cardano(CardanoCube) or Polkadot (Polka France, 2021) to name but a few.

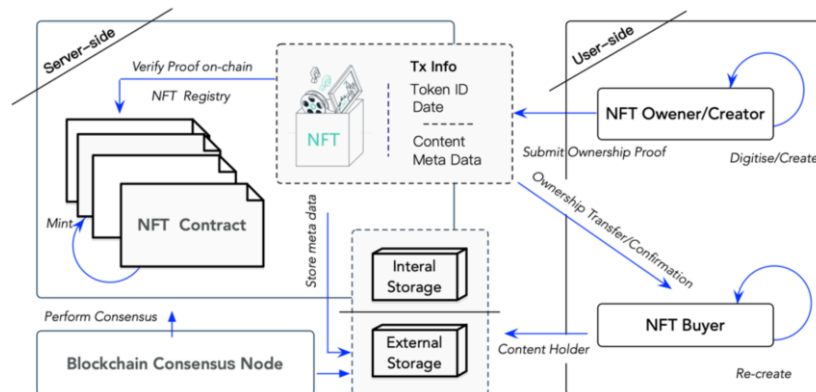
In the last few years, the NFTs market has been exploding with a market capitalization of 24B\$ (Byterum). Although NFTs are becoming more and more popular, they are still a very controversial subject in all fields because of numerous scams (BeinCrypto, 2022), volatility (Mazur, mieszko, 2021), lack of ethics or usurpation of intellectual property (Allouch, Benjamin, 2021) and counterfeiting (Marianne, 2022).

NFTs VS Cryptocurrencies		
	NFTs	Cryptocurrencies
Tradability	Non-fungible 1 NFT does not equal to another NFT	Fungible One crypto equal another crypto
Transactions	Minted through smart contract Can be modified in certain situations	Recorded based on launch and transfer of ownership
Fees	Paid to marketplace, transaction validators (gas fees), and creator of the collection	Paid to the exchange of the cryptocurrency as percentage per trade or on trading period basis (example, percentage of trading volume for a month)
Ownership	You own the NFT but copyrights still with creator (unless they specify differently)	Just like holding money. It is yours
Uses	Art, profile pictures, gaming, and utility	Store of value, movement of wealth, contracts, smart applications


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2.3.1 What is a NFT and how it is created

Wang, Qin explain that a NFT is a digital resource such as a music, an image, a 3D object or any other resource that is linked to a signed and unique digital asset using cryptography and the blockchain, which certifies its uniqueness and is therefore non-exchangeable. NFTs are therefore tokens that are cryptographic documents linked to an asset that can be exchanged in a



(“Model of NFT Systems” (taken from Wang, Qin, et al. “Non-fungible token (NFT): Over- view, evaluation, opportunities and challenges.”).

peer-to-peer network. The use of the blockchain allows to prove ownership and authenticity of a unique asset

So, when the NFT is mint or sold, a transaction is needed to activate the smart contract and a new block with all the necessary data about the ownership, authenticity and property of the NFT is created. Kistin Cornelius explains that the process of creating a NFT “consists of two roles: NFT owner and NFT buyer. A NFT owner digitizes the raw data from the transaction into the proper format, then stores it on a database external to the blockchain (or on a blockchain, but that is more costly). The owner then signs the transaction with a hash (or cryptographic signature made of a string of numbers) and sends the data to a smart contract. The smart contract processes the data, then mint or trades it on the blockchain as a transaction. Once it has been confirmed through mathematical consensus, the NFT is linked permanently to the unique hash identifier and the distributed blockchain record, where it cannot be changed.” Cornelius, Kristin (2021).

2.3.2 The properties of a NFT

NFTs are also based on the decentralized blockchain technologies. It shares most of the values and properties of the fungible currencies but with some differences (Medium, 2021).

- **Transparency:** The information of the NFT such as the owner, the creator, the price at which it was bought is registered in the blockchain and thus accessible to all.
- **Unchangeable & provable scarcity:** Since NFT are based on smart contract it allows the creator to develop a maximum number of these NFT and they are unchangeable once put on the blockchain.
- **Incontestable:** You can't question the ownership or the authenticity of the object because everything is verified by the blockchain.
- **Unique:** Each NFT in the blockchain has information that makes it unique. Even if a NFT has been created in 5000 copies. Each NFT will be rated from 1 to 5000.
- **Non-divisible:** NFT being non-fungible by definition they cannot be divided
- **Tradability:** They are exchangeable
- **Interoperability:** NFT can be exchanged, connected, used through several different platforms.
- **Programmability:** They are programmable and so we can insert the mechanics we want directly in the smart contract. Many of today's NFTs have more complex mechanics, like forging, crafting, redeeming, random generation, etc. The design space is full of possibilities.

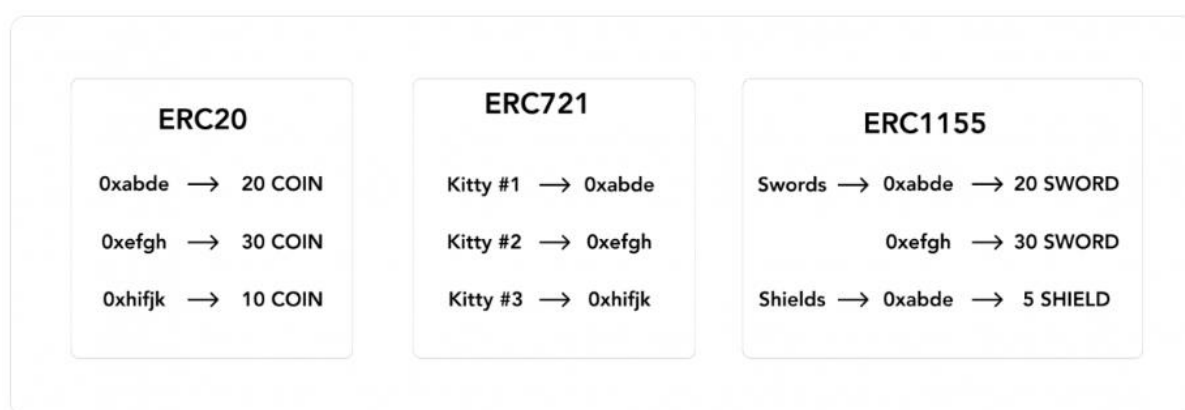
Of course, each NFT project has its own particularity and relies on different standards and protocols. They do not have to follow all these properties.

2.3.3 Token standard

First of all, it is important to differentiate between token and crypto-currency. A cryptocurrency such as bitcoin or Ethereum is a crypto with its own blockchain. A token on the other hand is a crypto based on the blockchain of another crypto.

A token standard defines the smart contract and features that the token issued by it has (Nftstars). There are several standards for tokens such as ERC-20, ERC-721 or ERC-1155. We are going to define here three of them but it is necessary to know that there are a lot of them, each one having their particularity or being on different networks. In this case we stay on the Ethereum network, ERC being "Ethereum Request for Comment" But it can also be on the Binance smart chain network (BEP-721) or Tezos (TZIP-12) and many others.

- **Erc-20:** Most tokens today are Erc-20. The purpose of these tokens is to replicate fungible currencies once the conditions are met and is mainly used for ICOs (initial coin offering). Indeed, the ERC20 guidelines require that the Smart Contract develops 6 mandatory functions and 3 optional ones which allows to standardize the tokens and allow the companies and the exchange site not to have to write a smart contract for each token. (Enjin)
- **Erc-721:** this is the first standard for non-fungible assets. This one creates a NFT for 1 asset only. This one allows to register the copyright in the NFT and it also allows more easily the development of royalties due to its transaction tracking and its history. (Enjin)
- **Erc-1155:** Created by Enjin this standard is compatible for fungible and non-fungible tokens. One of the biggest advantages of this standard is that it is possible to transfer multiple assets at the same time, up to 155 assets at the same time, which reduces network congestion and lower gas prices considerably. (Enjin)



Anatomy of the ERC20, ERC721, and ERC1155 standards. ERC20 maps addresses to amounts, ERC721 maps unique IDs to owners, and ERC1155 has a nested mapping of IDs to owners to amounts.

« The Non-Fungible Token Bible: Everything you need to know about NFTs | OpenSea »
https://opensea.io/blog/guides/non-fungible-tokens/#Non-fungible_token_standards.

2.3.4 On-chain and off-chain

When a developer creates a NFT he will have to decide if he wants to put the metadata directly into the smart contract and thus the token or host them separately.

2.3.4.1 On-Chain

When the NFT is hosted on-chain it means that the metadata that represents the NFT is directly implemented in the code and is not dependent on any application to exist. It would be possible to copy the code and introduce it in a compiler to get the digital asset. The disadvantage is that it is much more difficult to store a lot of information in the token. The other disadvantage is that depending on the nature of the NTF it is sometimes necessary that it is hosted off-chain in order to ensure its functionality as for example if it has a link with physical objects (OpenSea, 2020).

2.3.4.1 Off-Chain

When the NFT is stored off-chain it means that the metadata is stored outside the blockchain and that the NFT code refers via a pointer to the place where the metadata can be found. So, if the developer stores the metadata off-chain on a centralized server although the hash of your NFT will always be the same the code to which it is linked can be change or disappear if the server goes down. It is Often used for games to be able to handle balancing changes for example.

Another solution is to use the interplanetary file system (ipfs) to store the metadata. It is a peer-to-peer storage system and so the files are hosted across computers such that the file is replicated in many computers. This allows first of all to ensure the immutability of the NFT because it is impossible to modify the file since this one has a unique hash and that the change of the file would not be done on all the PCs and moreover as long as there is a node of connection which shares the file this one will not disappear (OpenSea 2020).

2.3.5 NFT intellectual property and counterfeiting

According to Atanas Kostov NFTs have become since late 2020 and early 2021 an important cultural and legal topic and should remain so for a while due to technical, legal and financial considerations. A NFT file contains specific information related to an image, a music, a 3d object or anything you want to put inside. Ethereum, supports smart contracts and when there is a transaction, there is a legal transparency between the parties since the acceptance or refusal of the transaction can be traced by the form, the recipient and the content of the chain of the software itself. The user who buys the NFT has only a right of use on the NFT and will not be the owner of the original work. Thus, the other right of the original work remains in the patrimony of the creator of the original work, unless the creator also transfers the intellectual property upon sale (Atanas Kostov 2021). So, although the creation of the NFT certifies to have a title of ownership on the blockchain, it does not certify that the underlying object is the intellectual property of the author and that he has the right to create this NFT. If this is the case, it can be considered as a counterfeit and the article L. 335-3 (Legifrance.gouv, 2009) of the French intellectual property code states that "any reproduction, representation or diffusion, by any means whatsoever, of a work of the mind in violation of the author's rights, as defined and regulated by law, is also a counterfeit offence". Therefore, it would be possible for a usurper to be condemned and the author of the original work to be compensated, but if this is easier with physical objects, it becomes complicated with digital objects such as NFT. Allouch Benjamin explain that the first problem is the identification of the author, the buyer and the reseller. And even if the owner of the rights manifests himself, how can we identify and condemn the seller under the cover of a pseudonym? What about the buyer? Is he a victim or an accomplice? Matthieu Quiniou explains that the French law provides that when there is an offence of counterfeiting. The counterfeit must generally be destroyed. However, the NFTs are registered in the blockchain and have the property of being immutable and therefore it is impossible to "destroy" them.

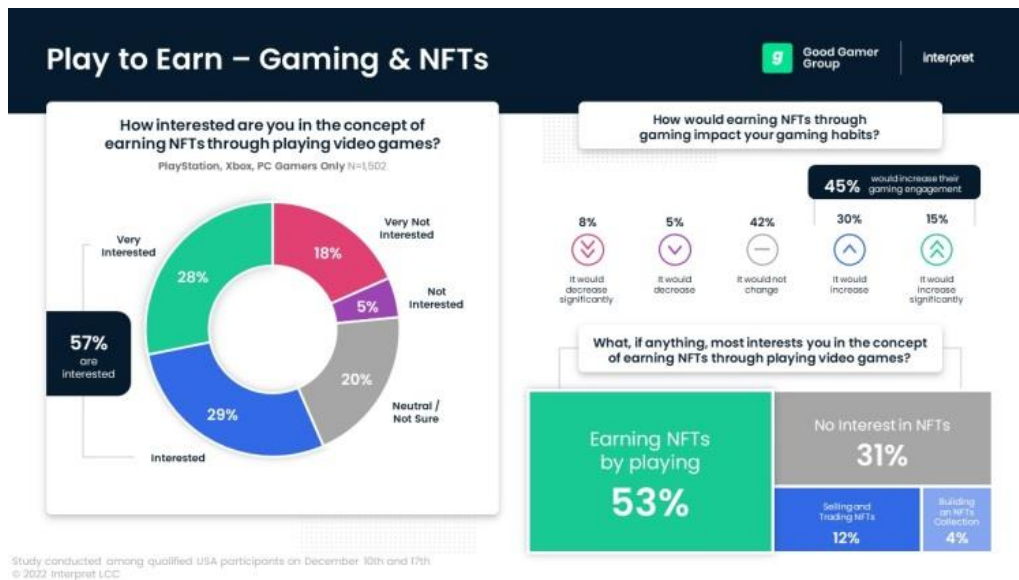
NFTs are becoming more and more important and it is important for the financial market and the law to focus on this problem. A solution proposed by Benjamin Allouch "It would then be up to the author to, for example, reveal his true identity to the oracle in charge of authenticating the NFTs before they are put on sale". The oracle being a software or a

hardware "whose purpose is to act as a bridge between the data of the blockchain and the external information on which it runs" (MitSoftware).

Finally, the blockchain being an international technology that does not belong to anyone, the question arises as to which authorities of which countries are competent in case of litigation.

2.3.6 Study on players' interest in NFTs

A study conducted by Interpret on more than 1500 gamers shows that 56% of them are interested in earning NFTs through the game and 45% of them indicate that the possibility of earning NFTs through the game would increase their engagement with the game.



Interpret's survey of gamers on NFTs. Image Credit: Interpret

2.3.7 Controversy about NFT in the Gaming industry

Following the emergence of crypto-currency and NFT, several video game companies such as Ubisoft, Square-enix or Zynga have announced their plans to add NFT to their games. These revelations did not have more to a large part of the gaming community what to make react the biggest companies of gaming.

Dean Takahashi explain that "Sega Sammy, the maker of the "Sonic the Hedgehog" game, expressed reservations about its NFT and crypto plans after "negative reactions" from users. Ubisoft, which makes titles such as "Assassin's Creed," said it had misjudged how

unhappy its customers would be after announcing a NFT program last month. A YouTube video about the move was disliked by more than 90% of viewers.”

Furthermore. “Valve, which owns the online game store Steam, updated its rules last fall to prohibit blockchain games that allow cryptocurrencies or NFTs to be exchanged. Tim Sweeney, CEO of Epic Games, maker of the game "Fortnite," said his company would steer clear of NFTs in its own games because the industry was riddled with “an intractable mix of scams.” Epic will still allow developers to sell blockchain games in its online store.

2.4 Conclusion of the literature section

This concludes the literature review. It has highlighted the evolution of the gaming industry and its relationship with technology and the economy. It has been expanding for several decades and is reaching more and more people around the world through a variety of supports. It needed to adapt and develop a new economic model which is essentially based on the online and digital sector. Indeed, this stresses more and more digital goods and services directly accessible inside the game itself. Profits are no longer coming from the sale of the game itself, which, by the way, are mostly available for free, and it is rather turning to free-to-play models that generate profits solely through the sale of digital goods accessible in the game and usable only in that game. Furthermore, they cannot be resold or even exchanged in some cases. Since the appearance of in-game purchases, these have often been the subject of discussion within the gaming community due to the price of these in whatever form they take, which may seem "pointless" at times, but which, nonetheless, bring in a lot of money for publishers.

The link between the gaming industry and new technology is undeniable. The emergence of these digital assets will push some actors to move towards new technologies such as blockchain or NFT in an attempt to integrate players into the gaming economy and give them more ownership. Blockchain has increasingly been present in our society. The goal is to create a consensus system that distribute, share trust and security with an infrastructure of certification and notarization.

Blockchain can take many forms and Ethereum is one of them. This one aim to create a decentralized web and applications. Thanks to this, we have the apparition of NFT composed of smart contract that gives the ability to a good or a digital asset to be

interchanged. It will allow us to prove the purchase or exchange of a digital asset and the proof that we own it without having to go through a third party. These can take many forms and be adapted to each type of business. Nevertheless, the use of NFT and blockchain is still a very controversial subject. Although some publishers are thinking more and more about integrating them into their games, but the gaming community does not seem to be quite ready yet.

The next point will discuss the study done on digital property in the gaming industry that was done among video game players. We will analyze the responses received and answer some hypotheses chosen specifically for the purpose of my study.

3. Analysis of the study on digital ownership

In this section we will analyze the results of the survey to answer our hypotheses. The interest here is to know how gamers feel about digital ownership in the gaming industry. The questions are focused on ownership, the right to enjoy and dispose of their video games and in-game purchases and ends with questions about blockchain and the use of NFTs in order to introduce the solutions that these could bring.

3.1 Methodology of the survey

Regarding the methodology, the creation of the questionnaire was the first step.

The purpose of this thesis is to know if NFTs via blockchain were a solution to solve a problem of value and digital ownership within the gaming industry. The technology of blockchain and NFT being very recent, the survey is positioned on the fact of knowing whether or not the problems of digital ownership are felt within the gamers and the gaming community and whether there is a demand from them for more control and ownership of their gaming digital assets. Therefore, I focused my questions to know first if they were aware of their level of control and ownership of their gaming digital assets. Then I asked if they were in favor of more control and ownership of them.

The survey ends with some questions about their interest in introducing blockchain and NFT technology into their online game. I didn't push the questions about NFTs and

blockchain any further because I wanted to focus my study on the players' feelings and needs but also because the education and knowledge in this matter is limited or even null.

The research consisted of a quantitative study composed of simple, non-ambiguous questions and answers. The questionnaire being totally in English and proposed mainly to French-speaking gamers, the investigator was available via an online chat in order to answer the question of the respondents if they encountered an obstacle because of the language or the understanding of the question. A "i don't know" or "neutral" answer is available for all questions so that the respondent can answer even if he has no opinion on the question asked.

The survey was established in two parts. The first one is only made up of arbitrary questions (Appendix 10.1) with unique ordinal or nominal choice allowing to determine first of all if the respondent corresponds to the profile searched here: players of video games confronted with digital game and in-game purchases. Then the investment of this one in term of money, time and the platform used. Finally, two questions concerning their feelings in terms of digital ownership of in-game purchases and online game purchases are introduced.

the second part is made up of questions (Appendix 10.2) using the 5-point Likert scale ranging from strongly disagree to strongly agree with answer 3 being neutral. (Appendix 10.2) in order to allow the processing of statistical data on their opinions about the digital property of online games, in-game purchases and online game accounts.

- The gender of the person was measured via a nominal dichotomous single choice question
- The age range of the respondent it was measured via a single ordinal choice question on pre-established age ranges
- Time spent playing video games per week was measured using a single ordinal choice question based on pre-determined time ranges.
- The platforms on which the respondent mainly plays was measured via a nominal multiple-choice question
- The download of a free-to-play game it been measured via a single choice dichotomous question
- The average monthly expenditure on software-only and in-game-only purchases was

measured via ordinal single choice question on a pre-defined budget range

- The average expenditure per month in in-game purchases only it has been measured via an ordinal single choice question on a pre-set budget range
- Regarding the questions related to the opinions about the digital privacy of in-game purchases, online games and game accounts it was measured via a Likert scale ranging from 1 - Strongly disagree to 5 - Strongly agree with the answer 3 representing the neutrality.

The survey was constructed in order to analyze quantitative data corresponding to the digital property in the gaming industry as well as to answer the hypothesis mentioned in the following chapter. The survey was pre-tested on a sample similar to the one that will be used for the real study. The sample used for the tests are French-speaking users, playing video games and being subjected to digital in-game purchases in the gaming. Following this pre-test, the wording "Do you think" was changed to "Do you feel" in order to avoid any ambiguity and to focus on the players' own feelings and not a general opinion. Moreover, the term "Non-consumable" has been added to the questions related to in-game purchases because they are closer to a service than to the purchase of a good.

3.2 Selection of the sample

The target populations are French-speaking online video game players. The survey period is from 12/7/2022 to 26/07/2022. The sample is non-probabilistic. The sampling technique used is convenience sampling as well as snowball sampling because the questionnaire was open to all and the participant was offered to share it if he/she wished. In order to not limit itself to a restricted perimeter and thus only the players of my restricted circle and my geographical zone, the questionnaire was shared and proposed via the network of streaming twitch on various French-speaking channels of streaming having the most viewers at the time of sharing. The possibility to answer the survey was proposed in the twitch chat during the live of those and the users wishing to answer it had to send a message to the researcher in order to receive the link of the survey. The interviewer was available to answer any questions regarding the survey. Due to the anonymity on the platform, users using a pseudonym, it was impossible to know in advance the social and demographic situation of the respondents, so we can't be sure that only French-speaking players were reached by the questionnaire. Moreover, the

questionnaire being only distributed on twitch, gamers who do not use this network could not be touched but it was allowed the respondent to share the questionnaire. Despite this, Twitch is the most watched video game streaming platform in the world and therefore we can consider that the people reached by this platform are relevant to answer the survey. The desired sample size was between 250 and 500 people and the final number was 462 respondents.

The use of the internet and the twitch platform for the diffusion of the questionnaire allows to keep the anonymity and to reach a maximum of players with different socio-demographic characteristics. Despite this, twitch users are mainly gamers in the 16-24 age group and men (76%), which does not exactly correspond to that of European gamers whose average age is 38 and the split between men and women is 53% for men and 47% for women. Among the answers received, only one survey was discarded because the respondent had never bought a game nor downloaded a free-to-play game. Moreover, all his answers were of a neutral type, Therefore, I considered it appropriate to remove his response from the analysis because it was not representative of a video game player.

3.3 Descriptive analysis

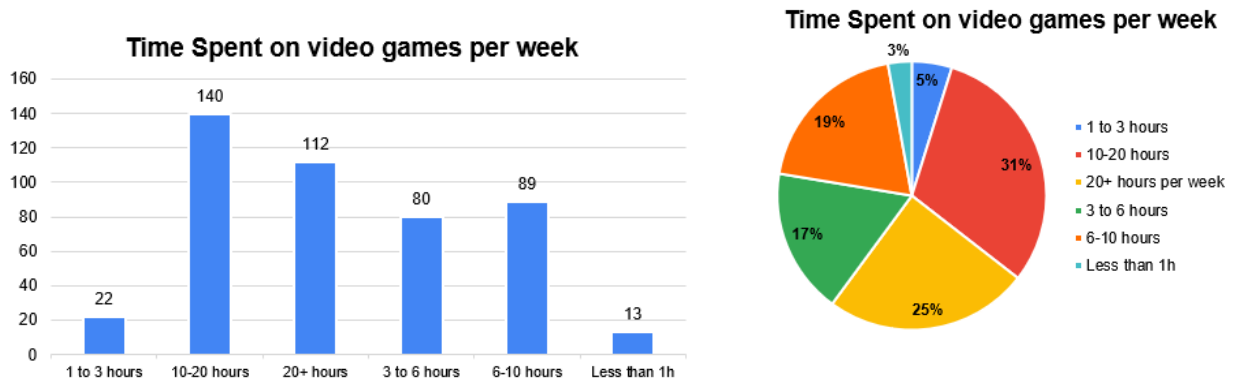
3.3.1 Sex and age of respondents



Among the respondents, the male/female ratio is 396 for men, 52 for women and for 10 others. Concerning the age of the respondents, the most represented age group is the 25-35 years old with 181 respondents followed closely by the 18-24 years old with 155 respondents. The age groups under 18, 36-50 and over 50 are respectively 59, 56 and 7 respondents. The male/female representation of 87% for men and 11% for women does not correspond exactly to what one would expect from the industry (I.S.F.E). However,

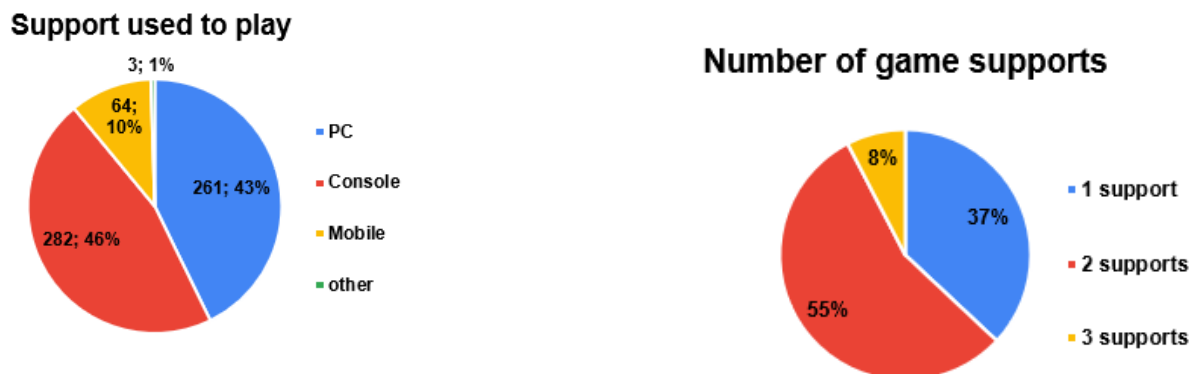
the age distribution is quite close to what one would expect from French-speaking videogame players (I.S.F.E)

3.3.2 Average playing time



Among the respondents 96.5% are regular gamers (more than 1 hour per week) and 3.5% are occasional gamers, which corresponds to a few percentages close to what we can expect from the community of French-speaking gamers (S.E.L.L)

3.3.3 Game support

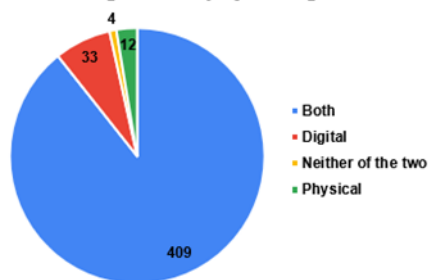


Among the respondents 55% play mainly on 1 support, 37% on 2 supports and 8% on 3 supports which does not exactly correspond to what we can expect from the French-speaking gamers community(S.E.L.L) but this can be explained by the use of the term " Mainly ".

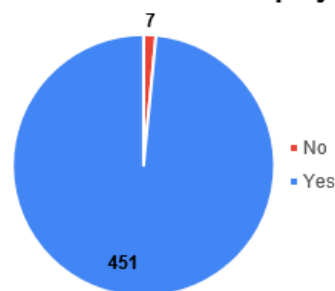
The most represented support is the home console 46%, closely followed by computers 43%, only 10% for mobile players and 1% for other supports. This is not exactly what you would expect from the distribution of media. Indeed the mobile support is under-represented. This can be explained by the fact that the Twitch network on which the survey was distributed is essentially made of content from console and PC games.

3.3.4 Purchase or download a physical, digital or free-to-play game.

Purchase of digital and physical games

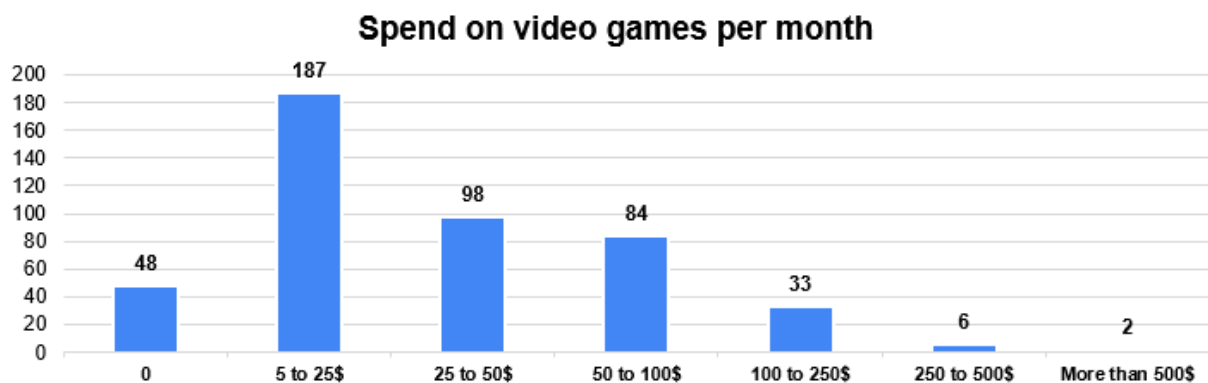


downloaded a free to play



96,52% of respondents said they have already purchased a physical and digital game. 98.5% of them also said they have already downloaded a free-to-play game. This follows the general trend that more and more people are turning to digital games but also that free-to-play games are attracting players.

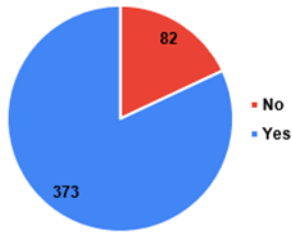
3.3.5 Spending on video games per month



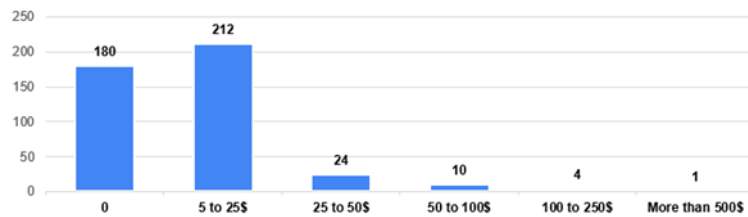
11% of the respondents say they never pay to play video games. 41% spend about \$5 to \$25 per month, 21% spend \$25 to \$50, 18% spend \$50 to \$100 and 9% say they spend more than \$100 per month.

3.3.6 In-game purchases and money spent on in game purchases

Used in-game purchases



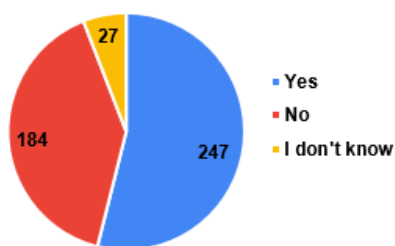
Spend on video games per month



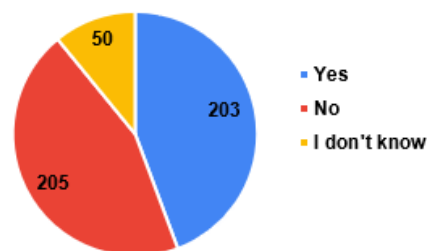
82% of respondents said they have used an in-game purchase but 42% said they do not spend money on in-game purchases. Among them, 49% say they spend between \$5 and \$25 per month on in-game purchases and 9% say they spend \$25 or more per month on in-game purchases.

3.3.7 Feeling of owning the game and in-game items after purchases

feeling of owning the game after purchase



feeling of owning in-game item after purchase



54% of respondents have a feeling of ownership after purchasing a digital game; 40% have no feeling of ownership and 6% have no opinion. In addition, 43% of respondents do not feel a sense of ownership after making in-game purchases, 45% feel a sense of ownership after making in-game purchases and 11% have no opinion.

3.4 Correlation tables

The following table shows the sigma of lineal regression between sex (Sig.a), age group (Sig.b), money invested in software games (Sig.c), money invested in in-game purchases (Sig.d) and time invested in video games (Sig.e) and survey part 2 questions Question1 to Question number 19 (Appendix 10.2).

correlation tables Coefficients^{a,b,c,d,e}

Modèle		Sig.a	Sig.b	Sig.c	Sig.d	Sig.e
1	(Constante)	,000	,000	,000	,000	,000
	Q1*	,170	,924	,059	,332	,520
	Q2*	,395	,296	,019	,199	,865
	Q3*	,980	,400	,947	,507	,572
	Q4*	,249	,029	,115	,931	,976
	Q5*	,911	,420	,189	,200	,755
	Q6*	,579	,593	,969	,511	,217
	Q7*	,285	,123	,396	,550	,107
	Q8*	,036	,706	,739	,121	,348
	Q9*	,641	,971	,805	,002	,090
	Q10*	,392	,470	,219	,036	,085
	Q11*	,384	,377	,173	,011	,029
	Q12*	,776	,854	,676	,000	,870
	Q13*	,126	,001	,097	,000	,376
	Q14*	,103	,000	,002	,000	,971
	Q15*	,047	,326	,149	,000	,036
	Q16*	,023	,539	,619	,000	,339
	Q17*	,063	,110	,030	,000	,794
	Q18*	,639	,905	,000	,895	,995
	Q19*	,791	,289	,001	,982	,516

a. Dependent variable: Are you a Man, Woman or other

b. Dependent variable: What is your age range

c. Dependent variable : What is your average monthly spend on video games (software only)

d. Dependent variable: how much per month do you spend on in-game purchases?

e. Dependent variable : Average time spent per month in video games

*Represents the variables of the second part of the questionnaire from 1 to 19

Through this table, we will be able to test several hypotheses regarding the relationship between these variables and respondents' opinions:

3.4.1 Hypothesis1: There is no a relationship between the gender of the players and Q1* to Q19*

Except for Q8*, Q15* and Q16* the Sigma of each hypothesis is >0.05 and therefore the hypothesis cannot be rejected and therefore the H1 hypothesis can be validated.

Concerning the hypotheses H2(Q8*), H2(Q15*) and H2(Q16*) the hypothesis can be rejected.

Therefore, to analyze the link between gender and the hypotheses, I performed an independent Student's T test.

Group statistics

	Are you a	N	Mean	standard deviation	Average standard error
It is normal that games that allow you to sell digital items only allow you to do so in exchange for credit that can only be used in their game/system/platform.	Man	396	3,13	1,263	,063
	Woman	52	3,52	1,196	,166
In-game purchases should be better regulated	Man	396	4,19	1,026	,052
	Woman	52	3,88	1,199	,166
Loot boxes (random reward system in exchange of a certain price) in video games are a form of gambling	Man	396	4,46	,961	,048
	Woman	52	4,13	1,121	,155

Test des échantillons indépendants

		Test de Levene sur l'égalité des variances		Test t pour égalité des moyennes						Intervalle de confiance de la différence à 95 %	
		F	Sig.	t	df	Sig. (bilatérale)	Différence moyenne	Std. standard		Inférieur	Supérieur
It is normal that games that allow you to sell digital items only allow you to do so in exchange for credit that can only be used in their game/system/platform.	Hypothèse de variances égales	,118	,731	-2,108	446	,036	-,390	,185		-,754	-,026
	Hypothèse de variances inégales			-2,198	66,847	,031	-,390	,178		-,745	-,036
In-game purchases should be better regulated	Hypothèse de variances égales	1,721	,190	1,990	446	,047	,307	,154		,004	,611
	Hypothèse de variances inégales			1,765	61,198	,082	,307	,174		-,041	,655
Loot boxes (random reward system in exchange of a certain price) in video games are a form of gambling	Hypothèse de variances égales	3,399	,066	2,283	446	,023	,330	,145		,046	,614
	Hypothèse de variances inégales			2,028	61,242	,047	,330	,163		,005	,655

So, we can see that there is a difference between men and women concerning these 3 questions. We can see that for Q8* women find it more normal than men that publishers allow us to sell/exchange our in-game purchases against credits usable only in their game/system/platform with an average of 3.52 against 3.13 for men and a t of -2.108.

For the question Q15* we can see that men have a different opinion from women concerning the regularization of in-game purchases with an average of 4.19 against 3.88 for women and a t of 1.9900.

Finally, men and women have a different view on question Q16*. Women have an average opinion of 4.46 while men have an average opinion of 4.13 that loot boxes are a form of gambling with a t of 2.283.

3.4.2 Hypothesis 2: the age range does not influence the players' opinion on Q1* to Q19*

Except for Q4*, Q13* and Q14*, the Sigma of each hypothesis is >0.05 and therefore the hypothesis H2 cannot be rejected and can be valid

Concerning the hypothesis H2(Q4*), H2(Q5*) and H2(Q14*) the hypothesis can be rejected. The equations of the regressions are the following:

For H2(Q4*): $*R_{Q4*} = 3.951 + 0.119 * \text{Variable}_b \rightarrow \text{Very low correlation (0.01)}$

For H2(Q13*): $*R_{Q14*} = 4.173 - 0.203 * \text{Variable}_b \rightarrow \text{Very low correlation (0.02)}$

For h2(Q14*): $*R_{Q15*} = 4.031 - 0.301 * \text{Variable}_b \rightarrow \text{Very low correlation (0.04)}$

3.4.3 Hypothesis 3: The money spent per month on video games (software) does not influence the players' opinion on Q1* to Q19*

Except for Q2*, Q14*, Q17*, Q18* and Q19* the Sigma of each of the hypotheses is >0.05 and therefore the hypothesis cannot be rejected and therefore the hypothesis 3 can be validated.

Concerning the hypotheses H3(Q2*), H3(Q14*), H3(Q17*), H3(Q18*) and H3(Q19*) the hypothesis can be rejected. The equations of the regressions are the following:

For H3(Q2*): $R_{Q2^*} = 4,361 + 0,079 * \text{Variable_c} \rightarrow$ Very low correlation (0,012)

For H3(Q14*): $R_{Q14^*} = 3,713 - 0,163 * \text{Variable_c} \rightarrow$ Very low correlation (0,02)

For H3(Q17*): $R_{Q17^*} = 3,096 + 0,123 * \text{Variable_c} \rightarrow$ Very low correlation (0,01)

For H3(Q18*): $R_{Q18^*} = 2,775 - 0,234 * \text{Variable_c} \rightarrow$ Very low correlation (0,04)

For H3(Q19*): $R_{Q19^*} = 2,342 - 0,223 * \text{Variable_c} \rightarrow$ Very low correlation (0,049)

3.4.4 Hypothesis 4: Money spent per month on in-game purchases does not influence players' opinions on Q1* to Q19*

Except for Q9* to Q17* the Sigma of each of the hypotheses is >0.05 and therefore the hypothesis cannot be rejected and therefore the H4 hypothesis can be validated.

Concerning the hypotheses H4(Q9*) to H4(Q17*) the hypothesis can be rejected. The equations of the regressions are the following:

For H4(Q9*): $R_{Q9^*} = 4,640 - 0,193 * \text{Variable_d} \rightarrow$ Very low correlation (0,022)

For H4(Q10*): $R_{Q10^*} = 2,066 - 0,161 * \text{Variable_d} \rightarrow$ Very low correlation (0,01)

For H4(Q11*): $R_{Q11^*} = 3,271 - 0,215 * \text{Variable_d} \rightarrow$ Very low correlation (0,022)

For H4(Q12*): $R_{Q12^*} = 3,752 - 0,298 * \text{Variable_d} \rightarrow$ Very low correlation (0,032)

For H4(Q13*): $R_{Q13^*} = 3,440 - 0,316 * \text{Variable_d} \rightarrow$ Very low correlation (0,039)

For H4(Q14*): $R_{Q14^*} = 3,069 + 0,285 * \text{Variable_d} \rightarrow$ Very low correlation (0,026)

For H4(Q15*): $R_{Q15^*} = 4,318 - 0,234 * \text{Variable_d} \rightarrow$ Very low correlation (0,03)

For H4(Q16*): $R_{Q16^*} = 4,561 - 0,196 * \text{Variable_d} \rightarrow$ Very low correlation (0,024)

For H4(Q17*): $R_{Q17^*} = 3,648 - 0,311 * \text{Variable_d} \rightarrow$ Very low correlation (0,028)

3.4.5 Hypothesis 5: The time spent playing per month does not influence the players' opinion on Q1* to Q19*

Except for Q11* and Q15* the Sigma of each of the hypotheses is >0.05 and therefore the hypothesis cannot be rejected and therefore the hypothesis 5 can be validated.

Concerning the hypotheses H5(Q11*) and H5(Q15*) the hypothesis can be rejected. The equations of the regressions are the following:

For H4(Q9*): $R_{Q11*} = 2,640 + 0,11* \text{ Variable_e} \rightarrow \text{Very low correlation (0,011)}$

For H4(Q10*): $R_{Q15*} = 3,809 + 0,79* \text{ Variable_e} \rightarrow \text{Very low correlation (0,01)}$

3.4.6 Hypothesis 6: "The majority of players value digital ownership"

First of all, the concept of digital property is still very fresh concept but it affects more and more people and in various subjects. The gaming industry is no exception to the rule and is even extremely affected by it. Indeed, the nature of these digital transactions is extremely unbalanced in favor of the platforms and against the users, transforming the owners into licensees. Therefore, it was logical to start by asking ourselves if video game players value this. To do this, we analyzed a table describing the frequency of responses to the question "Digital ownership in the gaming industry is important to me".

Digital ownership in the gaming industry is important to me

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	1	32	7,0	7,0	7,0
	2	39	8,5	8,5	15,5
	3	94	20,5	20,5	36,0
	4	99	21,6	21,6	57,6
	5	194	42,4	42,4	100,0
	Total	458	100,0	100,0	

We can see that 64% of gamers consider it important, 20.5% have a neutral opinion and 15.5% do not consider digital ownership in the gaming industry to be important for them. These results confirm our hypothesis that the majority of gamers value the ownership in the gaming industry.

3.4.7 Hypothesis 7;7^{bis};7^{ter}: "The majority of gamers believe that digital games⁷, in-game purchases^{bis} and online game accounts^{ter} should belong to the purchaser or account creator"

Then, as we have seen in the literature review, "ownership" in digital video games can be divided into 3 categories: our online game accounts, our digital games and our in-game purchases. According to Michie Jonathan, and Linda Lobao ownership is by definition the right to enjoy and dispose of things in the most absolute way. So, it seemed important to

me to find out if players believe that these should belong to the purchaser or the creator of the account. The hypothesis is divided into 3 parts for each category.

For this I do a descriptive analysis of the questions "Do you think digital games should be owned by the buyers? ", "Do you think your in-game purchases that are not consumable such as skins or characters should be the ownership of the person who buys it? "and "Do you think online gaming accounts should be the ownership of whoever created them?"

Do you think digital games should be owned by the buyers?

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	1	10	2,2	2,2	2,2
	2	10	2,2	2,2	4,4
	3	28	6,1	6,1	10,5
	4	66	14,4	14,4	24,9
	5	344	75,1	75,1	100,0
	Total	458	100,0	100,0	

Regarding the question of ownership of digital games, 69.5% of the players agree that digital games should be owned by the buyer, 6.1% have a neutral opinion and 4.4% disagree with this. These results confirm hypothesis 7.

Do you think your in-game purchases that are not consumable such as skins or characters should be the ownership of the person who buys it?

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	1	16	3,5	3,5	3,5
	2	17	3,7	3,7	7,2
	3	72	15,7	15,7	22,9
	4	82	17,9	17,9	40,8
	5	271	59,2	59,2	100,0
	Total	458	100,0	100,0	

On the question of online gaming accounts, 84.7% of players agree that online gaming accounts should belong to the buyer, 9.4% are neutral and 5.9% disagree with this. These results confirm hypothesis 7^{bis}.

Do you think online gaming accounts should be the ownership of whoever created them?

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	1	10	2,2	2,2	2,2
	2	17	3,7	3,7	5,9
	3	43	9,4	9,4	15,3
	4	80	17,5	17,5	32,8
	5	308	67,2	67,2	100,0
	Total	458	100,0	100,0	

Regarding the issue of online gaming accounts, 84.7% of players agree that online gaming accounts should belong to the buyer, 9.4% are neutral and 5.9% disagree with this. These results confirm hypothesis 7^{ter}.

3.4.8 Hypothesis 8;8^{bis};8^{ter}: "The majority of gamers believe that we should be able to sell/rent/rent/change our digital games⁸, in-game purchases^{bis} or online game accounts^{ter}"

Then to continue on the issue of digital ownership it seemed important to me to know if players think that players should have the possibility to sell/rent/trade their digital games, in-game purchases or online game accounts. To verify this hypothesis, I did a frequency analysis of the questions regarding the possibility to sell/rent/loan/trade our digital games, in-game purchases or online game accounts.

Do you think we should be able to sell/lend/rent/trade our digital games?

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	1	34	7,4	7,4	7,4
	2	32	7,0	7,0	14,4
	3	79	17,2	17,2	31,7
	4	93	20,3	20,3	52,0
	5	220	48,0	48,0	100,0
	Total	458	100,0	100,0	

Concerning the possibility to sell/rent/loan/trade our digital games 68.3% of the players think they should be able to sell/trade their digital games, 17.2% have a neutral opinion and 14.4% are against it. These results allow us to confirm hypothesis 8.

Do you think we should be able to sell/lend/rent/trade our in-game purchases?

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	1	60	13,1	13,1	13,1
	2	59	12,9	12,9	26,0
	3	84	18,3	18,3	44,3
	4	80	17,5	17,5	61,8
	5	175	38,2	38,2	100,0
	Total	458	100,0	100,0	

Concerning the possibility to sell/rent/loan/trade our in-game purchases. 55.7% of the players think they should be able to sell/trade their in-game purchases, 18.3% have a neutral opinion and 26% are against it. These results confirm hypothesis 8^{bis}.

Do you think we should be able to sell/lend/rent/trade our accounts on online video games?

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	1	118	25,8	25,8	25,8
	2	83	18,1	18,1	43,9
	3	82	17,9	17,9	61,8
	4	54	11,8	11,8	73,6
	5	121	26,4	26,4	100,0
	Total	458	100,0	100,0	

Regarding the possibility of selling/renting/loaning/exchanging our online game accounts. 38.2% of the players think that they should be able to sell/exchange their online game accounts, 17.9% have a neutral opinion and 43.9% are against it. These results do not confirm the hypothesis 8^{ter}.

3.4.9 Hypothesis 9: "the majority of players do not find it normal to be able to sell/exchange our in-game purchases only for credits usable only on the game/system/platform"

As we could see in the literature review, some publishers such as EA or Valve via the Steam platform offer us the possibility to resell in-game purchases but only against credits usable on their own game or platform. This raises the question of whether players find this normal or whether this solution is not suitable for the majority of players. To verify

this hypothesis, I did a frequency analysis on the question "It is normal that games that allow you to sell digital items only allow you to do so in exchange for credit that can only be used in their game/system/platform."

It is normal that games that allow you to sell digital items only allow you to do so in exchange for credit that can only be used in their game/system/platform.

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	1	63	13,8	13,8	13,8
	2	68	14,8	14,8	28,6
	3	130	28,4	28,4	57,0
	4	124	27,1	27,1	84,1
	5	73	15,9	15,9	100,0
	Total	458	100,0	100,0	

The results show that 28.6% of the players do not find it normal, 28.4% have a neutral opinion and 43% of the players find it normal. These results allow us to invalidate hypothesis 9.

3.4.10 Hypothesis 10: "The majority of players are interested in winning digital items"

3.4.10^{bis} Hypothesis 10^{bis}: "The majority of players would increase their commitment to a game if it were possible to earn digital items that could be sold/trade/rented/leased"

As seen in the literature more and more games offer to earn digital items in exchange for "experience" in the game or by completing several missions daily/weekly or over a defined period. This system is set up by video game publishers in order to increase the player's engagement but also to frustrate him and make him put his hand in the wallet in order to unlock the digital items faster.

The following frequency tables will show us if indeed players are keen to win digital items and if the fact of being able to win them would increase their engagement towards the game.

You are interested in winning digital items in a game

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	1	36	7,9	7,9	7,9
	2	47	10,3	10,3	18,1
	3	104	22,7	22,7	40,8
	4	123	26,9	26,9	67,7
	5	148	32,3	32,3	100,0
	Total	458	100,0	100,0	

Regarding winning digital items 60.2% said they are interested in winning digital items in a game, 22.7% were neutral and 18.1% said they were not interested. Thus, hypothesis 10 can be confirmed.

If it were possible to earn digital items in a video game that could be sold/lend/rented/traded it would increase your engagement in the game.

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	1	68	14,8	14,8	14,8
	2	77	16,8	16,8	31,7
	3	91	19,9	19,9	51,5
	4	111	24,2	24,2	75,8
	5	111	24,2	24,2	100,0
	Total	458	100,0	100,0	

Concerning the fact that the possibility to win saleable digital items would increase the players' engagement in the game. 48.5% said yes, 19.9% had a neutral opinion and 31.7% said it would not increase their engagement. Therefore, hypothesis 10^{bis} cannot be confirmed.

3.4.11 Hypothesis 11: "The majority of players think that loot boxes are a form of gambling"

3.4.11^{bis} Hypothesis 11^{bis}: "The majority of players think that loot boxes should be banned"

We have seen that many publishers have implemented a loot box system and that some countries like Belgium or the Netherlands have banned them as a form of gambling, but what do players think?

Loot boxes (random reward system in exchange of a certain price) in video games are a form of gambling

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	1	14	3,1	3,1	3,1
	2	16	3,5	3,5	6,6
	3	33	7,2	7,2	13,8
	4	92	20,1	20,1	33,8
	5	303	66,2	66,2	100,0
	Total	458	100,0	100,0	

Regarding whether loot boxes are a form of gambling 86.2% of the players agree with this, 7.2% have a neutral opinion and 6.6% disagree which can be confirmed by hypothesis 11.

Loot boxes should be banned

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	1	69	15,1	15,1	15,1
	2	62	13,5	13,5	28,6
	3	86	18,8	18,8	47,4
	4	82	17,9	17,9	65,3
	5	159	34,7	34,7	100,0
	Total	458	100,0	100,0	

Regarding the fact that loot boxes should be banned. 52, % of the players agree with this, 18,8% have a neutral opinion and 28,6% do not think that loot boxes should be banned. Therefore, hypothesis 11^{bis} can be confirmed.

3.4.12 Hypothesis 12: "The majority of gamers are interested in the use of blockchain in video games"

3.4.12^{bis} Hypothesis 12^{bis} "The majority of players are interested in using NFTs in video games"

In the literature review section on blockchain and NFTs, we saw how these technologies could solve digital ownership issues in the gaming industry. The question now is whether players are interested in using these technologies in the gaming industry.

I am interested in the use of blockchain in the gaming industry

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	1	236	51,5	51,5	51,5
	2	37	8,1	8,1	59,6
	3	115	25,1	25,1	84,7
	4	30	6,6	6,6	91,3
	5	40	8,7	8,7	100,0
	Total	458	100,0	100,0	

We can see that 51.5% of the players are interested in the use of blockchain in video games, 25.1% have a neutral opinion and 8,1% are not interested. Therefore, we can invalidate hypothesis 12.

I am interested in the use of NFT in the gaming industry

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	1	305	66,6	66,6	66,6
	2	51	11,1	11,1	77,7
	3	56	12,2	12,2	90,0
	4	15	3,3	3,3	93,2
	5	31	6,8	6,8	100,0
	Total	458	100,0	100,0	

Concerning the use of NFTs in the gaming industry, 66.6% of the players are interested, 12.2% have a neutral opinion and 11.1% of the players are not interested in the use of NFTs in the gaming industry. Therefore, we can invalidate the hypothesis 12^{bis}.

3.5 Summary of the results

The main objective of this study was to evaluate the gamers' feelings about their ownership in the gaming industry regarding their video games and in-game purchases as well as their interest in introducing blockchain and NFTs in the industry. The purpose was to determine if the players were aware of their level of ownership in order to know their feelings regarding the digital property. Furthermore, how important they considered the possibility of reselling/exchanging their games and in-game purchases. Overall, we wanted to know their opinion regarding the new economic models implemented by publishers via in-game purchases. Last but certainly not least, I wanted to determine if age, gender, time invested, or money invested in video games or in-game purchases had an impact on the opinion of the players.

The study showed that age, time and money invested by the players had little influence on the players' opinions. For the questions where there was a correlation between the players' opinion and their age, time invested or money invested, the correlation was extremely weak and can therefore be considered null. Regarding gender, there is a difference between men and women only on the issue of loot boxes being a form of gambling, that they should be better regulated and that some publishers only offer to sell digital goods in exchange for credits that can be used on the game/platform/system. Women are more likely to think that loot boxes are a form of gambling and that they should be better regulated. Regarding the possibility to sell our digital items for credit directly within the game or platform, women find this more normal than men.

Results show us that the majority of gamers value digital ownership in the digital industry and that digital games and in-game purchases should be owned by gamers and that gamers should be able to sell/trade/rent them. Besides that, most gamers find it normal that we can only sell/trade our digital items for credits that can be used on the publishers' games/platform/system. Furthermore, many of the players would like to earn digital items, still, it would not increase their interest in the game.

Players also consider loot boxes as a form of gambling and that they should be banned and better regulated as it is in some European countries. Finally, the majority of gamers are not interested in the use of blockchain and NFT in the gaming industry.

These results show us that gamers are demanding more ownership in the gaming industry and that most of them feel this ownership after buying a digital game or an in-game purchase when they actually not own them. So, we can be confident to say gamers are asking for more control over their property and that this notion is non-negligible for publishers whom will have to bring solution to this problem. Therefore, it seems important to me to make players and developers aware of this issue.

To finish, gamers are against the use of blockchain and NFT in video games. In order to complete this point of view, it would be interesting to realize a qualitative study concerning the use of blockchain and NFT and to try to understand the level of knowledge of the players on the subject but also the reasons of the disinterest of the players concerning these technologies and to interview developers and editors of video games in order to have their point of view on the question.

So, as we have seen from this study, gamers are looking for more control and ownership of their digital gaming assets. Even though they are not interested in using NFT and blockchain, we will see in the next chapter how these new technologies can bring benefits to players and publishers but also some detriments.

4. Implementation of blockchain and NFT in the Gaming Industry

In this chapter we will try to explain what are the current problems that can be encountered in the video game industry regarding digital property and see what are the advantages and disadvantages of implementing blockchain via non-fungible tokens in the video game industry for users but also for publishers.

4.1 Introduction

If there is one field in which NFT can make a difference and bring a contribution that could change the game, it is in the gaming industry. Especially when you consider that digital represents 93.4% of the revenues generated by the industry in 2021 (Batchelor, James., 2021). Moreover, the online microtransaction market will generate \$59.49 billion in 2021(ReportLinker, 2021).

While dematerialized games and in-game purchases are becoming more and more common, what about our relationship to all these digital assets? Davidovici-Nora explain that we find ourselves in a position where most games are turning to a Games as a Service model and therefore the ownership of these digital goods is reduced to zero in most cases because it is impossible to resell our games or exchange them and even it is possible that we no longer have access to them (Rietkerk, Sven, 2022). It is often the same for our in-game purchases. Even if some platforms or publishers set up a system of sale or exchange it is usually a mechanism where the money and skins remain within the system and it is not possible to recover money FIAT via this sale.

So, can blockchain technology and NFTs successfully open a door and help this problem by bringing ownership, value and scarcity to the gaming industry?

4.2 Example of a current problem

4.2.1 Counter-Strike global offensive

August 2018 a young youtuber of 18 years, by the name of Heitman under the pseudonym Mcskillet, known in particular for these videos on skins in cs:go and even called the "king of skins" by some of the community would have committed suicide by car causing the death of a mother and her child. A few days before, Valve (creator of cs:go and owner of

the steam platform) would have banned the account of the young man blocking him from trading with other users which would prevent him from trading for several hundred thousand euros. In addition, CS:GO Magic, the site Heitmann co-operated, was shut down in 2016 after Valve updated its policies about skin gambling sites (Du cann, Gerard, 2018). Although access to the use of skins is still possible in the game, after a ban it is impossible to exchange our skins.

Steam allows you to sell skins on the community market, which allows you to earn money, but it is only available and usable on the platform itself, and a transaction fee of usually 10% is charged directly to Steam. Therefore, the only way to sell your digital items for FIAT money is to go through third party sites where no security is put in place and you take the risk of being banned because it is against the conditions of steam. If you feel like selling the whole account directly, be aware that this is also against the terms and conditions and you could be banned. "Steam accounts cannot be bought or sold. An account is for the personal use of its creator only... When Steam's support team notices an account has been sold, the account will be permanently locked whether or not it is currently in the possession of the buyer or seller" (Ketfi, Cassim, 2021).

4.2.2 Fortnite

Fortnite, a game that has become extremely well known since the launch of its free to play battle royal mode in 2018 is estimated to have generated in 2018 and 2019 a total of \$ 9.186 billion (Ketfi, Cassim, 2021) of turnover. The game being free to play, most of the income comes from in-game purchases which are purely cosmetic. Here also, impossible to sell your account indeed we can read in the conditions of Epic " "You may not do or attempt to do any of the following with respect to the software or any of its parts, sell, rent, lease, license, distribute, or otherwise transfer it." (Epic games). Again, if you get banned or want to recover some of the money invested during several years it becomes complicated and involves risks.

4.2.3 Hearthstone

Hearthstone is a card game where you have to open decks with real or virtual money, but using virtual money takes a lot longer to get the cards you want to use in the game, so in this case it is a purchase that can give you an advantage. The company also prevent you

from selling your game account. "You are not allowed to buy or sell WoW*(HS following the same rules) items, products, or services for real money. Accounts involved in real money transactions may be penalized under our End User License Agreement."

(Activision Blizzard)

These examples are not cases apart in fact most of the online games work in the same way, Indeed if we look at the top 20 games most played in June 2022 on PC only 2 have no in-game purchase (Newzoo, 2022) and if we take the top 10 mobile games most downloaded, 100% contain in-game purchases (Wikipedia, 2022) The same observation can be made for console games (Newzoo, 2022). Whether it's our skins, our games or our accounts we can't sell or trade them. As we can see, most of the games and platforms are quite strict in their conditions regarding in-game purchases and the use of their game. Finally, we pay more for a service than for a good. Henceforth, what could blockchain and NFT bring to the player and the developer. Are they looking forward to this new technology and more control over their digital purchases in gaming?

4.3 Benefits of introducing NFT in videogames for gamers

4.3.1 Ownership

"NFTs, be they artworks or a digital artifact like this, are the latest playful creations in this realm, and the most appropriate means of ownership that exists. They are the ideal way to package the origins behind the web." Sir Tim Berners-Lee, (2021).

At the moment game-video purchases and traditional in-game purchases for the most part (except GoG, humble which are drm free) are one-time purchases, not sellable and transferable only on the game platform. All items and games purchased are locked. The investments in terms of time and money are mostly dedicated to stay on the platform until the game goes down.

The use of NFT would allow the creator of the game to attach assets to tokens that he would have previously created and would own. From then on, any person who would buy the token would become the owner. Thus, the purchase of the token would give the player the ownership of their in-game purchases instead of the developers. This way the players

would have full control over their digital assets. They could transfer or exchange them, use them in other gaming or non-gaming environments. Resell them for Fiat money or cryptocurrency. Moreover, the existence of the hash and the token are guaranteed for life so it is possible to continue to use it even after the end of a game. The NFT being registered in the blockchain it is easily possible to prove the property of the asset but also to go back to the origin of the creator in order to avoid fraud and scam.

4.3.2 Scarcity

NFTs will bring rarity to video games. Previously it was impossible to have something digitally rare. Although the creator could only sell a certain number of certain in-game purchases or only for a limited time. Nothing prevented the creators at any time to put it back on sale and sell it endlessly. The NFTs work with a smart contract, it will be possible using the blockchain to create this notion of scarcity. The developer can make sure that rarer assets are only created in a certain number of quantities, whereas more common assets for example can be created infinitely, which adds scarcity and can be verified directly through the code. When NFTs are put on the blockchain they will be unique and the number of assets issued can be easily tracked and verified.

4.3.3 Interoperability and immutability

While at the moment in-game purchases that you buy are only usable in one game because they are on centralized servers. On the opposite since a NFT is on a decentralized server, the assets can be used by other games and thus be usable and interoperable across multiple environments. A virtual sword in an adventure video game can be used in another game as a sword or another object such as a vehicle or an armor. Moreover, if a creator decides to stop developing his platform, other people can create another platform in order to allow people who own these NFTs to continue playing with them. This notion goes hand in hand with immutability, indeed if a game goes down the NFT does not disappear and can always be exchanged, used or sold. The NFT can't be duplicated either because of the permanent record each NFT generate upon creation. This also increases the lifetime of your digital assets, because if you want to change from one game to another you don't have to reinvest money for each game.

4.3.4 Reward & play to earn

As noted in the S.E.L.L. data, video game players can spend several hours a week on their games. The integration of NFTs will allow the game developer to reward players for their time and effort via NFTs that they can resell or use. Players can then participate in the economy and ecosystem of the game. This encourages players to invest more in the game by increasing their gaming experience.

4.4 Detriments of introducing NFT in videogames for gamers

4.4.1 Speculation

One of the problems that we can encounter with some games based on NFTs and blockchain is the speculation. Indeed, let's take the example of the game *axies infinity* where we can buy small creatures and lands that will allow us to earn resources that we will be able to resell or use to improve our creatures so that it brings us more resources and so on. To buy these creatures you have to use the AXS crypto currency created for the game. We then find ourselves in a game where we invest hoping to have a return on investment but also to speculate on the value of the cryptocurrency too. From then on, many players will start to invest in in-game assets with the hope of making money and generating profit instead of using them to simply play and thus diminish the gaming experience of the players who will have to match the prices to be able to compete and from then on, it will be a "pay to win" game.

4.4.2 Barrier at the entrance

The first barrier that we will find is the complexity of certain concepts. Indeed, the concepts of blockchain, NFT, gas fee can take time to fully understand. Moreover, the use of wallets is not easy and at the slightest mistake it is possible to lose all your funds without any possibility to recover them as with a centralized network. This can lead to a certain aversion to use these technologies.

Another barrier that can be encountered is the price. Indeed, many games based on blockchain for the moment will ask you to invest money in NFTs to be able to fully enjoy the game. Prices can reach high amounts. At the time of writing the minimum price for a

land on The Sandbox and Decentraland is respectively 1.33 Eth for (1 807€)(OpenSea) and 3420 Mana (2872€)(Decentraland) for example.

4.4.3 Scam, fraud & legal aspect

These new technologies and new forms of monetization can attract malicious actors. Whether it is by "exit scam", "rug pulls" where the developer runs away with all the money collected, through ponzi pyramids or pump and dump, every method are good to scam people. Many developers sell NFTs before the game is even developed by promising capital gains and benefits to early investors. The best example is with the crypto "squid game" a crypto that claimed to be based on the Netflix series and promised a six round game where 90% of the money would go to the winner. In November 2021, the price of the crypto went from 2800e to zero and the founder ran away with over 2.5 million dollars (Ponciano, Jonathan, 2022).

At the level of the law, NFTs are a "legal UFO, there is no legal definition of a NFT to date because of its hybrid nature, at the crossroads of several distinct legal concepts. Nevertheless, today there are growing and significant issues that encourage the attachment of NFTs to a legal category in order to determine their legal regime" according to Georges Tchikaidze.

4.4.4 Trust

"The most common type of NFT is a piece of code that is written into the blockchain. That code is made up of various bits of information. The ERC-721 standard for NFTs specifies elements that must be present, and some that are optional. The first core element of a NFT is a number known as the TokenID, which is generated upon the creation of the token; the second is the contract address, a blockchain address that can be viewed everywhere in the world using a blockchain scanner. The combination of elements contained in the token make it unique; only one token in the world exists with that combination of TokenID and contract address. At its very core, the NFT is simply these two numbers. However, there are other important elements that can be present in the contract. One is the wallet address of the creator, which helps to identify the NFT with its originator. Most NFTs also commonly include a link to where the original work can be found, this is because "the non-

fungible token is not the work itself, rather a unique digital signature that is linked in some way to an original work” said Andrew Guadamuz.

Table 1

NFT Metadata	
Item Metadata	
Contract Address	Token Metadata
0x8c5aCF6dBD24c66e6FD44d4A4C3d7a2D955AA ad2	<pre>{ "symbol": "Mintable Gasless store", "image": "https://d1c3m3wxxz9zd.cloudfront.net/ 613b908d 0000000000/861932402826187638543675501608353605 31676033165 "animation_url": "", "royalty_amount": true, "address": "0x8c5aCF6dBD24c66e6FD44d4A4C37a2D955AAad2", "tokened": "86193240282618763854367501608353605316760331 "resellable": true, "original_creator": "0xBe8Fa52a0A28AFE9507186A817813eDC1 "edition_number": 1, "description": " A beautiful bovine in the summer sun "auctionLength": 43200, "title": "The Clearest Light is the Most Blinding", "url": "https://metadata.mintable.app/mintable_gasless/86193 240 "file_key": "", "apiURL": "mintable_gasless/", "name": "The Clearest Light is the Most Blinding", "auctionType": "Auction", "category": "Art", "edition_total": 1, "gasless": true }</pre>
Token ID	
86193240282618763854367501	
608353605316760331651808345700	
084608326762837402898	
Token Name	
The Clearest Light is the Most Blinding	
Original Image	
https://d1c3m3wxxz9zd.cloudfront.net/613b908d-19ad-41b1-8bfa0e0016820739c/0000000000000000/86193240282618763854367501608353605316760331651808345700084608326762837402898/ITEM_PREVIEW1.jpg	
Original Creator	
0xBe8Fa52a0A28AFE9507186A817813eDC14 54E004	

Image: Moringiello, Juliet M. and Odinet, Christopher K., *The Property Law of Tokens* (November 1, 2021). U Iowa Legal Studies Research Paper No. 2021-44 Used with permission.

Therefore, although we remain the owner of the NFTs forever, if the developers stop the development or put the game down our NFT is no longer useful if nobody develops anything around it. It is important to understand that we are the owner of a hash and a piece of code that can be interpreted in applications and not directly of the digital object itself.

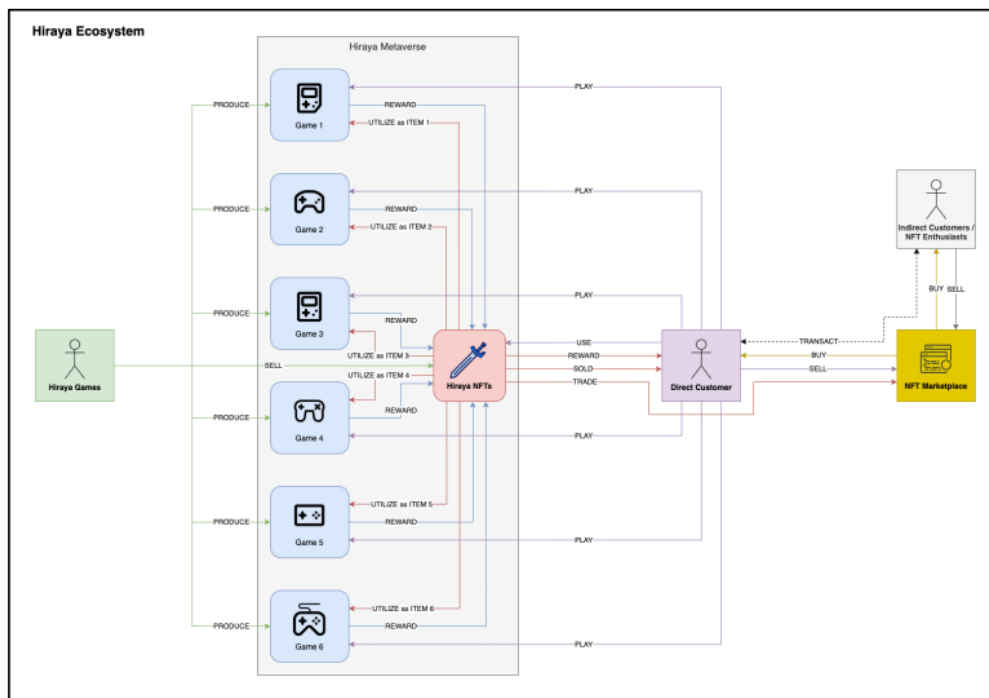
4.5 Benefits of introducing NFT in videogames for Creator

4.5.1 Interoperability

The number of genres and sub-genres games is numerous. The interoperability between games can allow developers to gather several different types of players in order to develop a community and more invested players who will be more likely to put money into the game. Hiraya games: an independent game development studio specializing in

the production of mobile games incorporating non-fungible tokens explains that their objective in their business plan is:

“To present an innovative solution to the increasing demand for a better gaming experience, and alternative methods of play and interaction. The proposed business is unique and has the potential to be a major disruptor in the industry. Its planned offerings will change the perception of how players value games and will be different from the ones currently in the market” (Hiraya Games, 2022).



Peralta, Paulo Andrew. « Hiraya Games: An Independent Game Development Studio Specializing In The Production Of Mobile Games Incorporating Non-Fungible Tokens », 1 January 2022. <https://doi.org/10.13140/RG.2.2.19675.64800>.

In a survey of 288 people in the U.S. conducted by Hiraya Games, 87.1% of respondents are interested in interoperable games and 69.2% are willing to pay more for an in-game item that they can reuse in another game environment.

4.5.2 Royalties

In addition to sales, a new revenue model is possible in which a part of the revenue generated by transactions between privately owned items is distributed to the creator of the NFTs. Players can convert the purchase of game items into asset investment concepts

rather than simply spending money. As a result, more active item purchases and transactions can be created (Wang, Qin, Rujia Li, Qi Wang, and Shiping Chen, 2021)

4.5.3 Partnership

NFT offers the possibility to develop a new communication strategy and new business opportunities through partnerships with other actors in the same sector but also with totally different actors. If partnerships with other games seems logical because of the interoperability. The NFT allows the developer to make partnerships with non-digital companies in order to attract new participants. For example: going to see a certain movie would give us ownership of a NFT that could be used in a game. Buying a certain brand of clothing would also give you a NFT that can be used as a cosmetic in a game. Adidas, Dolce and Gabbana, Vans, Gucci, Louis Vitton and many others have already partnered with video games (Wang, Duhan, Qianmingyan Ren, Xinyu Li, Yiman Qi, and Qi Zhou, 2022)

4.5.4 Source of funding

The appearance of NFT can also be a new way to finance projects. Startups can create NFTs and sell them to raise funds and then integrate the NFTs into the game. These NFTs can be just virtual objects to be used on the game but they can also be a collective property. For example, the royal project in the music industry is a platform that allows creators to tokenize and monetize their music project and thus give a part of the rights to fans who would buy the tokens and receive royalties according to the number of sales issued, allowing the singer to finance his project (Pimentel, Benjamin, 2021). The same principle can be used for the gaming industry.

4.6 Detriment of introducing NFT in videogames for Creators

4.6.1 High Fees transaction

All transactions linked to a NFT cost more than a simple transfer on a centralized network. Each transaction has a higher or lower cost depending on the period. Smart contracts involve computational resources and storage to be processed. Moreover, when a high number of NFTs are required, there is a certain cost to be considered when launching this type of project that would not be the case with a centralized network. (Wang, Qin, Rujia Li, Qi Wang, and Shiping Chen, 2021). At the time of writing, prices for transferring a NFT

can vary between 50c to 15\$ depending on the time and the network used and the influx of it (Etherscan.io).

4.6.2 Slow transaction

NFT-related transactions are not as fast as on centralized networks and can take up to several minutes or even hours to be transferred depending on the time of day, the network used and the network flow (Etherscan.io).

This can be a problem in games where the transfer of NFTs can be more or less important for the sake of economy and gameplay and therefore reduce the game experience. "Conquering this issue requires a redesign of blockchain systems, optimization of its structure or improvement on the consensus mechanisms. Existing blockchain systems cannot fulfill such requirements" (Qin Wang, Rujia L, Qi Wang and Shiping Chen, 2021).

4.6.3 Regulatory Uncertainty

"The issues currently haunting NFTs: consumer protection, warranties, disclaimers, and most importantly whether buyers of NFTs will have the legal right to go to court at all" (Fairfield, Joshua. 2021)

The laws and legislation regarding NFTs and cryptocurrencies are still unclear and vary from country to country. A developer or a player can very quickly enter in a legal pitfall without even realizing it. Therefore, it is important to be well informed on the subject before anything else.

4.7 Summary of the analysis

To recap, advantage of implementing non-fungible tokens in video games is that they can be used to represent unique, one-of-a-kind in-game items or assets. This can create a sense of rarity and exclusivity around certain items, which can increase their value to players and potentially lead to a secondary market for trading. This can also generate additional revenue for the developer, particularly if the NFTs are highly demanded. So NFTs would be used to provide players with more control over their in-game assets and reward them for the time and the money they have invested in the game. It would give the opportunity to the player to play-to-earn and create an ecosystem where players can

participate. Furthermore, NFTs can be used to provide players more control of their in-game assets because they are stored on a blockchain and owned by a specific user. They cannot be duplicated or taken away by the game developer so they will have more confidence in their ownership of in-game assets and potentially make them more invested in the game. In addition, NFTs can be used to reward players for their contributions to the game, by providing them with unique items for participating in events or for achieving certain milestones. This can create incentives for players to engage with the game and may help to retain players over time.

On the other hand, the implementation of non-fungible tokens in video games has drawbacks. Indeed, players must have some knowledge of the blockchain in order to understand and use it, which can create a barrier for some players. Moreover, it increases the complexity within the game, these must also learn to manage a portfolio in order to manage their NFTs, understand how buying and selling on a marketplace and how these works. Which may discourage a number of players to embark on the adventure. In addition, the use of NFTs can lead to accessibility and fairness issues. For example, players who cannot or will not purchase NFTs may be at a disadvantage compared to those who can afford to do so. This could create a division in the gaming community and lead to resentment or frustration among some gamers.

Finally, the use of NFTs may also introduce security risks. Because NFTs are stored on a blockchain, they can be vulnerable to hacks or other types of cyberattacks. This could result in players losing access to their valuable in-game assets, which could be frustrating and disheartening.

To conclude, what we can retain from all this is that the implementation of NFTs can change the whole dynamic of the gaming ecosystem, but for this to happen, it will have to go through a period of adaptation, understanding and acceptance from players and developers so that all this can be done in the most efficient way and without denying either party.

5. Further Analysis of Existing project

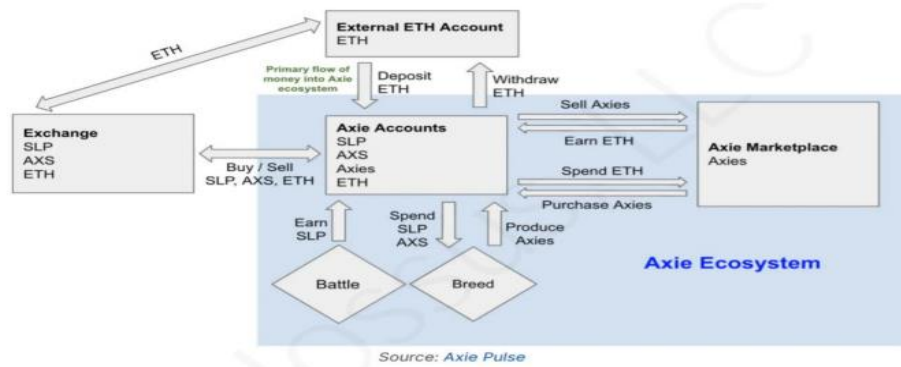
In this last chapter we will analyze some projects that have already embarked on the adventure of creating games based on NFTs and how they have set up an ecosystem and an economy around them within their game. All the information used for this analysis was extracted from the official websites of these projects.

5.1 Axie infinity

Impossible to talk about NFTs videogames without mentioning Axie infinity. Axie infinity is a fighting video game based on blockchain created in 2018 by Sky Mavis. Heavily inspired by Pokémon, Axie infinity is a fighting and card game where each team is composed of 3 Axies that you can collect, trade, breed, reproduce, and fight. Each Axie is a unique NFT with specific genetic characteristics such as 4 stats, 6 classes, 3 secrets and 6 body parts (AxieInfinity, 2022)

5.1.1 Ecosystem

The Axie infinity system is composed of 2 tokens. Axie infinity shards (AXS) and smooth love poition(SLP). Axie infinity shards are governance tokens. They allow to manage the decentralized organization of Axie infinity and to have a vote in the development of the platform such as influencing how the treasure funds are used or how the funds should be spent in the ecosystem. The smooth love potion is a token that you get by participating in fights in the game. This one is only used to breed new axies. Indeed, each axie can reproduce up to 7 times with another axie and for that you have to invest SLP. At the beginning there were 4088 "original axies". The limitation of reproduction is put in place to avoid hyperinflation. To play the game you will need 3 axies to start the adventure. To buy axies you will have to go to the axie marketplace and buy an axie from another player in exchange for ETH.



Axie Ecosystem illustrated by Axie Pulse

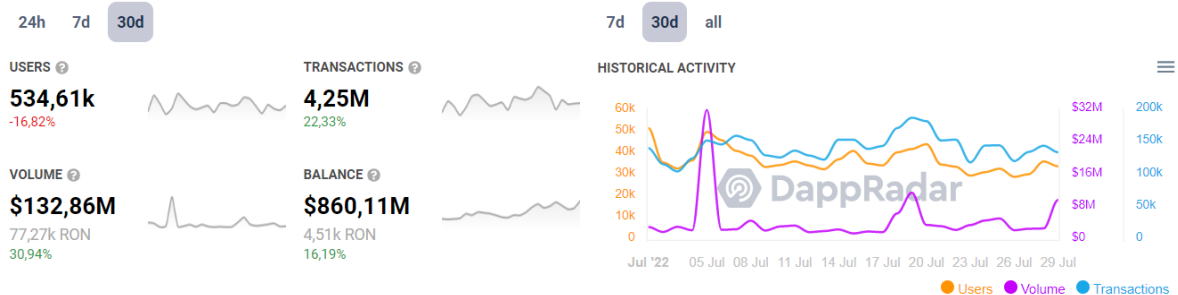
Pulse, Axie. "Is Axie Infinity Sustainable?" Substack newsletter. *Axie Pulse* (blog), August 23, 2021. <https://axiepulse.substack.com/p/is-axie-infinity-sustainable>.

5.1.2 Economy

The whitepaper for Axie Infinity states that "Axie has a 100% player-owned real money economy. Rather than selling items or copies of the game, the game developers are focusing on developing the player-to-player economy. The marketplace fees go into a community treasury, the use of which will be guided by AXIE owners. Developers earn money from the AXS tokens they hold. Axies are created by players using game resources (SLP and AXS) and are sold to other players. You can think of the Axie as a nation with a real economy. The holders of the AXS token are the government which receives tax revenues. The inventors/builders of the game, Sky Mavis, hold ~20% of all AXS tokens."

Axie Infinity statistics

This data represents the raw on-chain activity of the tracked smart contracts



For this data we are tracking: 14 Axie Infinity Smart Contracts →

DappRadar. "Axie Infinity." Accessed July 30, 2022. <https://dappradar.com/multichain/games/axie-infinity/>.

At the date of 30/07/2022 we see that in 1 month there has been more than 4.25 million transactions so about 140,000 per day for a total of 534,000 users.



"Smooth Love Potion Price Today, SLP to USD Live, Marketcap and Chart | CoinMarketCap." Accessed July 30, 2022. <https://coinmarketcap.com/currencies/smooth-love-potion/>.

The SLP currency that can be earned by players and used or resold is very unstable and fluctuates widely, which can cause problems for players who sometimes invest a lot of money. This one went in one year from 0,081e to 0,303e to be at the time of writing at 0,0043e.

Moreover, the more players there are the more SLP are created and not enough are burned or used via the creation of axes. To counter this, the developers have made a drastic update so that players will receive less SLP when playing in the 20th season of the game. "We are creating more burn mechanisms [...] and we are also looking at ways to strategically reduce supply to balance the economy" (AxieInfinity, 2022).

So, the influence that developers can have on the economy is at the opposite of the idea of decentralization but is necessary for the good of the game economy.

5.1.3 Property in Axie infinity

"Axie Infinity started as a passion project when we learned about the interesting and immutable ownership structures made possible by the blockchain through playing other decentralized games. We've always been frustrated by the lack of true ownership made possible by centralized gaming, and thought that the Ethereum network in particular has offered us a playground in which to build our dream game." (Trung Nguyen, 2021)

The game operating on the blockchain allows everyone to get into the game by buying axies that become the property of the player, in fact he can play with it, exchange it or resell it. The axie will always exist on the blockchain and its characteristics are immutable. Although your NFT belongs to you, this does not prevent the game developer from modifying the impact of the characteristics in the game via nerfs or buffs. There is nothing to stop the game creator from banning you and even if you still own the NFT you will not be able to use it in the game. So, if no other platform uses these NFTs, it is no longer "useful". According to Axie Infinity's whitepaper, the Sky Mavis team aims to "decentralize all aspects of the game and its governance once the network has become sufficiently decentralized". Only time will tell if the team will succeed in decentralizing all aspects of its game.

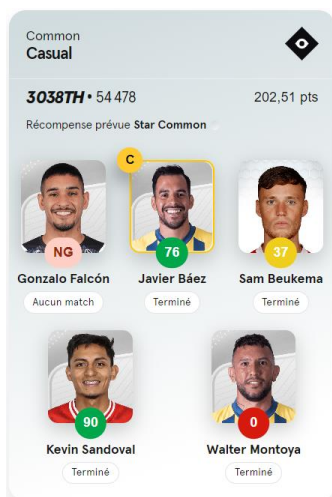
5.2 Sorare

Sorare is a card collecting and fantasy soccer game that was created in late 2018 by Nicolas Julia and Adrien Montfort. Sorare has been talked about in 2021 because the French start-up has made the biggest fundraising ever seen in France for a total of 680 million dollars in 2021 valued at 4.3 billion dollars. The principle of the game is to compose a team with NFTs that represent cards of soccer players and collect a maximum of points by tournaments. From then on, players can buy, trade, play or resell their cards for cryptocurrency.

5.2.1 Ecosystem

When you create your account, you will be offered 12 "common" cards to play the game without having to go through the wallet. These 12 offered cards are cards do not have scalability and are not NFT and therefore you cannot resell or trade. This allows all new

players to understand the game system before they start playing. The game is presented through tournaments of different leagues with different rules for the use of cards (only limited card, only rare card, etc...) When you have chosen the league in which you want to play, you must compose your team with the cards you have. The team is composed of a goalkeeper, a defender, a midfielder, an attacker and an additional player of any position. So, every week you can compete in several leagues that take place during 4 days. From then on, the players you choose will get points according to their performance in real life during their match. Of course, if your player does not play during the period or is a substitute he will not get any points. At the end of the period the points of each player are added up and prizes are given to the players according to their ranking.



Here the team created collected 202,51. The goalkeeper Gonzalo Falcon did not play during the game and the player Walter Montoya did not enter the field. The team finished 3038th out of 54 478 and the reward was a "Star common" card.

"Sorare : Own Your Game." Accessed July 18, 2022. <https://sorare.com/>.

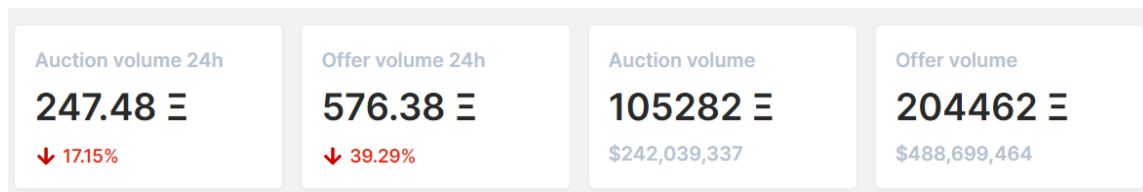
At the time of writing Sorare covers more than 44 leagues and 222 clubs, including Ligue 1, Liga, Jupiler Pro League and Serie A. Some competitions require players with NFT. For each soccer season 1111 cards are created per player whose teams and leagues have an agreement with Sorare. Each player has officially 1 unique card, 10 super rare cards, 100 rare cards and 1000 limited cards per season. Commons cards are unlimited. (Sorare)

5.2.2 Economy

Although the game is based on blockchain and crypto-currencies, Sorare has managed to break the technical barrier to entry for all novice users. Indeed, it is possible to directly buy cards via your bank card without having to go through a wallet and the purchase of cryptocurrency.

When you start to climb in the leagues it is possible to receive prizes in NFT according to each league. This is where the play to earn system makes sense.

Every day new cards are created and auctioned by Sorare for a period of about 3 days where everyone can place a bid until the time limit. Another way to get cards is to buy them back on the resale market from other players who have won, bid for them or bought the card before. The currency used in the game is Ether, but it is possible to buy directly with euros and the conversion is done automatically. In order to avoid gas fees, Sorare uses a layer 2 of Ether. Therefore, only the gas fee for deposit or withdrawal in Ethereum have to be paid. Purchases and resale of cards on the platform do not cost any fees because they are directly covered by Sorare. On this picture we can see the exchange volumes of the Sorare cards



"SorareData - Step up Your Game." Accessed July 30, 2022. <https://www.soraredata.com/>.

- Auction volume 24h: the total expenses (in ETH) realized by the managers on the primary market (the auction market) during the last 24h (the indicator below indicates the evolution compared to the previous 24h).
- Offer volume 24h: the total amount spent (in ETH) by managers on the secondary market during the last 24 hours (the indicator below shows the evolution compared to the previous 24 hours).
- Auction volume: the total amount spent on the primary market (auctions) since the launch of Sorare!
- Offer volume: the total amount spent on the secondary market (exchange between managers) since the launch of Sorare.

Sorare earns money by producing new cards and auction them off, which are more or less high depending on the rarity and the player on the card. The most expensive card ever bought on Sorare is the Erling Haaland card of unique rarity, sold for \$682,919.07.

5.2.3 Property in Sorare

Each NFT can be sold on the Sorare market but can also be removed from the game and sent on Ethereum to be sold directly on other platforms such as OpenSea. We can read in the F.A.Q of Sorare that:

"Your Sorare cards are truly yours. With a NFT from Sorare, you can use it in Sorare competitions, keep it as a collectible, transfer it to another platform, sell it, trade it, play it in another game, create your own game where you can use it, etc....Currently, you can use your Sorare cards in at least four games outside of Sorare: Soraredata Cups ,SorareMega ,SorareBrag ,Sorare's Global Fantasy Football Game "

Again, although the cards are implemented in the blockchain and a certain number of cards are created by smart contract, nothing prevents Sorare from creating more cards or changing the rules of the game and the scarcity of cards at any time. the hash would still be unique but another hash representing the same player could be created. This is where the concept of ownership and decentralization makes sense because if Sorare do that, nothing would prevent another start-up from taking over the project using the same NTF. One could also easily imagine a soccer simulation game like FIFA that would use Sorare's NFTs.

5.3 Metaverse with sandbox

At Connect 2021, CEO Mark Zuckerberg introduced Meta, "which brings our apps and technologies together under a new corporate brand. Meta's goal will be to bring the metaverse to life and help people connect, find communities and grow businesses."

Metaverse is a word we've been hearing and using more and more often since Facebook's name change shook up the business. But what is a Metaverse?

If we take the definition of Stylianos Mystakidis "The Metaverse is the universe of post-reality, a perpetual and persistent multi-user environment merging physical reality and digital virtuality. It is based on the convergence of technologies that enable multi-sensory interactions with virtual environments, digital objects and people, such as virtual reality

(VR) and augmented reality (AR). "The Metaverse is thus an interconnected network of social and networked immersive environments in persistent multi-user platforms. It allows the user to seamlessly communicate in an embodied manner in real time and dynamically interact with digital artifacts. Its first iteration was a network of virtual worlds where avatars could teleport to each other. The contemporary iteration of the Metaverse features social and immersive VR platforms compatible with massively multiplayer online video games, open game worlds, and AR collaborative spaces." (Mystakidis, Stylianos in the Encyclopedia of MDPI, 2022)

Sandbox was founded in 2011. Sandbox is originally a 2D mobile game where players can create their own universe. Upon its release the game received the award for best game of the year from apple. In 2017 after the bull market of bitcoin and Ethereum (DeMatteo, Megan, 2022) the creators of the game Pixowl took the opportunity to announce the creation of a 3D game based on the Ethereum blockchain which would then work with NFT.

5.3.1 Ecosystem

One of the most important notions in the sandbox is that all the content of the game is generated by the users. For this purpose, The Sandbox has provided 2 softwares. Vox editor which allows to create assets which will be NFT of type ERC-1155 such as characters, buildings or clothes and a game maker which allows to build games in 3D which will also be NFT of type 1155 usable in their "Land" by using the assets created or buy on the marketplace. The lands are plots of parcels under the form of NFT ERC-721 with a number of 170 000 that can be purchased. The lands can be bought by individuals or companies. The plots allow to create a space where it is possible to make events, sell NFTs in a store, make publicity, put a game at disposal, the possibilities are infinite. (The Sandbox.)



Attri, Shubham. "The Sandbox Tokens And The Types Of Sandbox Tokens," December 30, 2021. <https://deasilex.com/types-of-sandbox-tokens/>.

5.3.2 Economy

The main currency in the metaverse the sandbox is the cryptocurrency Sand which is an ERC-20 type token under the Ethereum blockchain. Sand is the main utility token in the sandbox ecosystem and is also a governance token. Therefore, it can be used to buy lands and assets on the marketplace of the sandbox. In addition, holding Sand tokens allows you to vote on decisions regarding the development of the sandbox.

Creators of content such as games in the metaverse can if they wish make their game free-to-play but also charge you to play. In the same way it is possible to earn sand by playing the game and thus become a play-to-earn. Sand can be used to hire in-game creators or as rewards for contests hosted on Land.

"From all \$SAND transactions, a 5% transaction fee is applied. 50% of this fee is allocated to the Foundation Fund and the other 50% is allocated to the Staking Pool.

The money received from the transactions is used to improve The Sandbox ecosystem and to pay the developers, designers and artists that The Sandbox works with. The other half of the money raised through the transaction is given back to the people who have chosen to stake their Sand. The maximum supply of sand is 3 Billion and the current supply is 1.2 Billion. The price of a sand at the time of writing is 1.32€ and peaked at 7.5€ in November 2022. The 24-hour trading volume at the time of writing is €435,619,443 with a peak of 9.9B in November 2022.

5.3.3 Property in The Sandbox

Whether its token utility, assets, lands or games, all these elements are NFTs, so it is possible to trade, sell, and even rent them. On the Gitbook of the sandbox we can read that the creators of the assets as well as the designers of the games owns 100% of the rights of that assets or that game. In addition, all assets and games are copyrighted to the creators or the designer as long as they do not infringe another entity's existing copyright. "For example, making a Captain Bunny-Ears superhero ASSET would be perfectly fine and would be copyrighted to you. But making a Captain America superhero ASSET would be a violation of Marvel and Disney's copyright and trademarks." (The Sandbox, 2021)

"When you upload content to The Sandbox, you grant us a worldwide, non-exclusive, royalty-free, perpetual, irrevocable, sub-licensable (through multiple tiers), transferable right and license to use, reproduce, publicly display, distribute and adapt the publicly shared Assets and Games for the purposes of developing, distributing, providing, improving, and promoting the Services, our activities, and your publicly shared Assets and Games. You further grant TSB the right to use your name and trademarks, if any, in connection with our use of your publicly shared Assets and Games." (The Sandbox, 2021)

It is important to note that if you want to use an asset in several lands, you will have to buy the asset several times because each asset is a unique token and cannot be replicated or cloned. When creating the asset, the creator can define the number of copies available through the use of GEM, up to a maximum of 200 copies of the asset and to a minimum of 20,000. The rarer assets can also have more attributes that will allow them to increase the stats of the item in magic, power, defense, speed and luck. Each Gem can randomly give stats ranging from 1-25 and thus the assets will be able via their attributes to be even rarer and more unique. (The Sandbox)

CATALYST Tier	GEM Sockets	Attributes	ASSET Copies
Common	1	Up to 25	Up to 20,000
Rare	2	Up to 50	Up to 4,000
Epic	3	Up to 75	Up to 1,500
Legendary	4	Up to 100	Up to 200

6. Limitations and suggestions for future research

Going through this thesis, we quickly realize that it is mainly an exploratory research. As I progressed in my findings, I quickly realized that in-game purchases as well as the use of blockchain and NFTs are growing topics for future studies.

The main limit of this thesis is to not have explored in depth the players' criticism towards the NFT and the blockchain integrated as their game and their vision of these new technologies. Thus, an interesting extension of my thesis would be a qualitative study orchestrated with players on games based on NFTs rather than a quantitative one. Another point that could add value is to interview developers of these so-called games and thus to be able to analyze the point of view of the developers and the complications that they could meet during the implementation of the NFTs and the blockchain within the games. It would have been interesting to see their views on allowing players to be direct stakeholders in the ecosystem and economy of a video game. Furthermore, the lack of responses from mobile gamers is constraining, as they represent more than half of the gamers in the world. Knowing that mobile video games are exclusively digital, their opinion could add a lot of value.

Unfortunately, within the current circumstances, it was difficult to carry out such qualitative research, given the time and number of potential interviewees. To add onto that, the actors are essentially located in different continents, given the time zone and distance, it was difficult to get in touch with.

Moreover, as this topic is still controversial, many of them did not want to answer my questions, fearing of backfire, as it was the case with Ubisoft, to name a few. In addition, for many companies that are thinking of embarking on the adventure, it is only a premise and cannot allow interviews on the subject.

Although the questionnaire of this analysis is already quite rich, looking at my results, we could have gone a little further such as questions on how they would like in-game purchases to be implemented, on play-to-earn, their opinion and their knowledge on NFT and blockchain and so on.

Thanks to this master thesis, I had the opportunity to analyze if there was a problem perceived by gamers regarding in-game purchases and digital property in the gaming industry and then to analyze if a new approach and solution could be implemented via blockchain and NFTs. The gaming economy and ecosystem is still evolving and the use of NFTs and blockchain is still in its early stages. It would be interesting to continue to follow the integration of in-game purchases, blockchain and NFTs within the gaming industry in future research.

7. Conclusion

The main objective of this study was to highlight the problem of digital property in the video game industry from the gamers' point of view and the analysis of a possible solution via blockchain and NFTs.

One of the methods used to achieve my goal was to highlight the problems related to digital property in the video game industry. Thus, we could notice that the video game industry has developed enormously during the last few years, both in terms of technological performance and in terms of their economic models. While at the beginning it was mostly physical games following a pay-to-play model, video games quickly turned to digital pay-to-play or free-to-play models integrating in-game purchases such as microtransactions. Revenues from in-game purchases far exceed those from the sale of the game itself for most games. In addition, gamers are increasingly turning to digital game purchases rather than physical game purchases.

From this transition, the question of the digital property of the buyers towards these digital goods was raised. The observation is clear, while on a physical game it is possible

for the buyer to resell or even exchange it, the digital games as well as the microtransactions are impossible to resell or exchange. As a result, actors have gone from owning a good to enjoying a digital license that gives access to content that favors platforms and disfavors users, turning owners into licensees.

Based on this observation, a study was conducted with several players from the French community. I first wanted to determine if the issue of digital ownership was important to them and also to know if they felt like owners of their game and digital assets. Moreover, I wanted to know if they were in demand of being able to exchange their video games and digital items and if the profile of the player influenced the opinion on the question or if this problem affects all types of players.

First of all, the study showed that the profile of the player in terms of gender, age, money and time invested in video games had little or no influence on their opinion on the issue. Whatever the profile of the player, he is of the opinion that he should be the owner of his digital video games, his digital items but also of his online game account and that he should be able to sell or exchange these assets except for the online game account. The study also showed that players were not against integrated purchases as long as they did not provide an in-game advantage and remained purely cosmetic. In addition, most players are keen to win digital items while playing their game, but being able to win digital games would not increase their commitment to the game.

Some publishers have set up a selling system directly integrated within their video games but which only allows to get credits usable within their platform or their game. This solution seems to be enough for most players but for me it is only a transitional solution and is not sustainable in the long term. Gamers have also shown their disinterest in the use of blockchain and NFT in video games. However, it seems to me that it would be a potential solution if it is well implemented. Some editors are already leaning towards this solution but the community does not seem to agree and does not hesitate to show their discontent.

Then an analysis of the implementation of a solution to this problem of digital property via blockchain and NFTs was made. This analysis showed that NFTs could provide more

ownership and authenticity by providing users with unique and indisputable proof of ownership of a virtual object. In addition, NFTs can provide liquidity by allowing players to easily sell or trade virtual items with other players and therefore create an economy around these virtual items and within the game.

On the other hand, the complexity of blockchain and NFT technology may discourage some players from using them. In addition, the transaction cost for exchanging digital objects can be an issue as well as the volatility when NFT is tied to a certain cryptocurrency as we have seen in projects that already use NFT in their ecosystem. Overall, the use of NFTs in games is still in the early stages, and it is not yet clear what impact they will have on the industry. However, they have the potential to create new opportunities for game developers, players, and collectors, and to change the way games are monetized and played.

In conclusion, this study depicted gamers' expectation regarding their digital gaming goods and the solutions which could be considered to satisfy their needs. Throughout this paper, we could notice that the video game industry is still in full expansion and that it continues to evolve, still going through never-ending transformation of its offers and its economic models.

Gamers are investing more and more time and money, so I think it's important to offer them a service and products that meet their expectations. The study highlighted that gamers are demanding more control over their digital assets. To meet this need, we have analyzed a new approach to digital property within video games via the new technologies of blockchain and NFTs. Although these technologies are still in their infancy, it seems to me that this is an interesting approach that publishers and developers should consider integrating into their video games.

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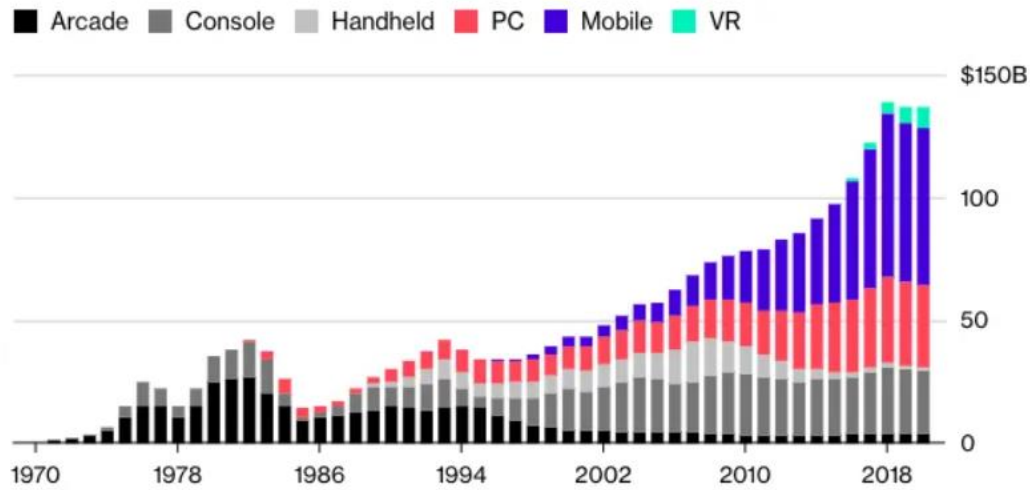
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9. Appendix of the literature review

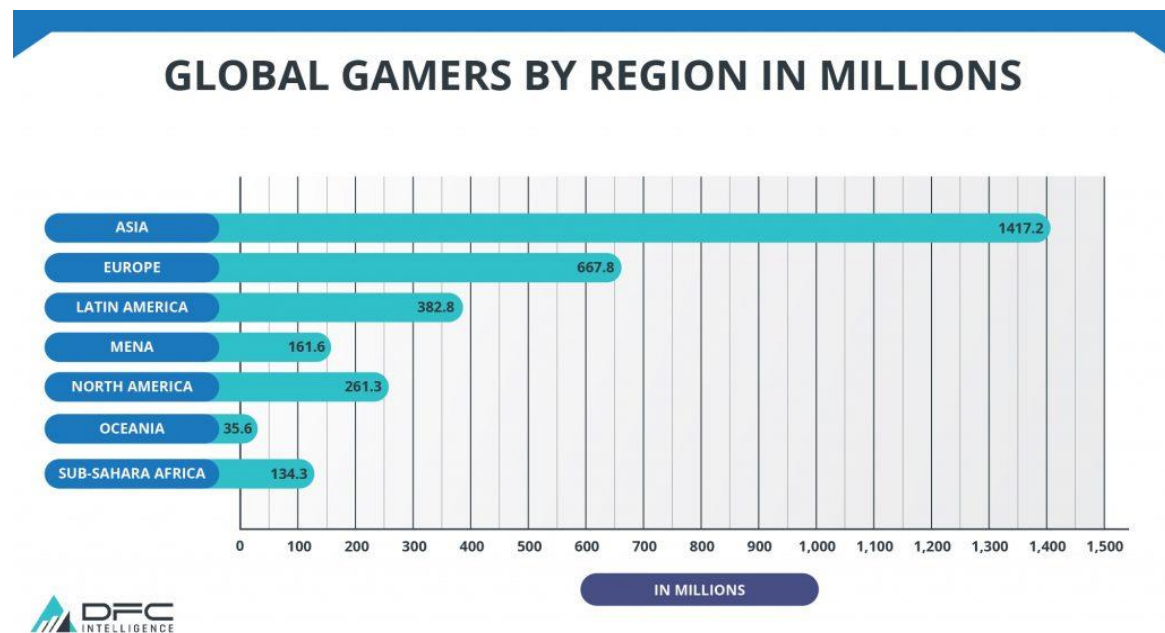
9.1 Gaming industry revenues



Source: Pelham Smithers

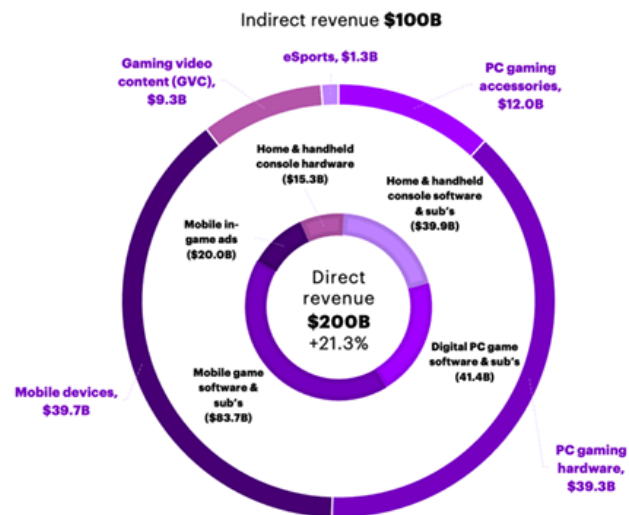
Gaming industry revenue © Pelham smithers

9.2 Global gamers by region in millions



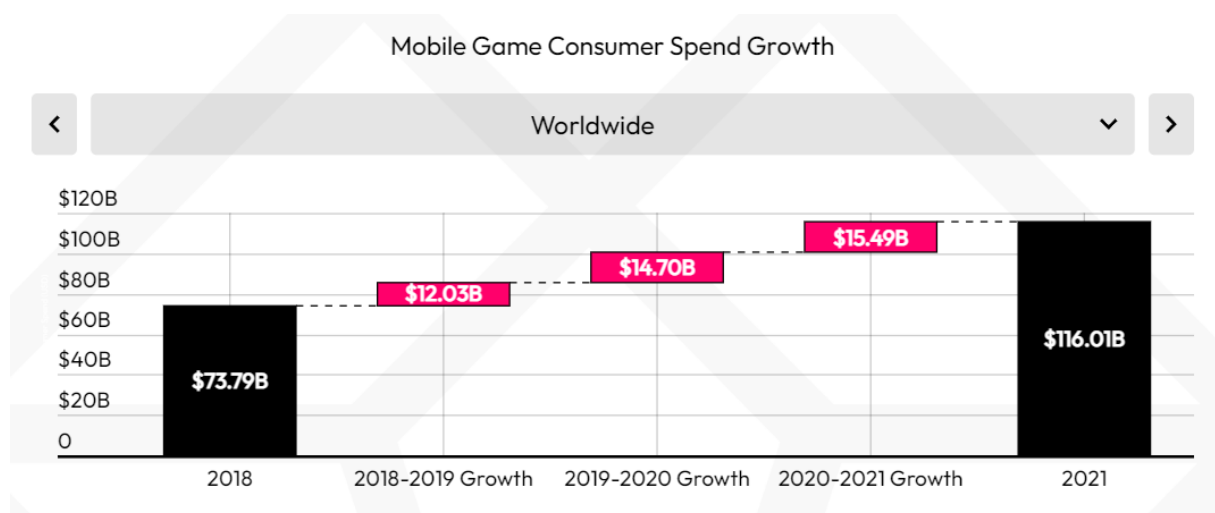
Global gamers by region in millions © DFC intelligence

9.3 Direct and indirect revenues of the gaming industry



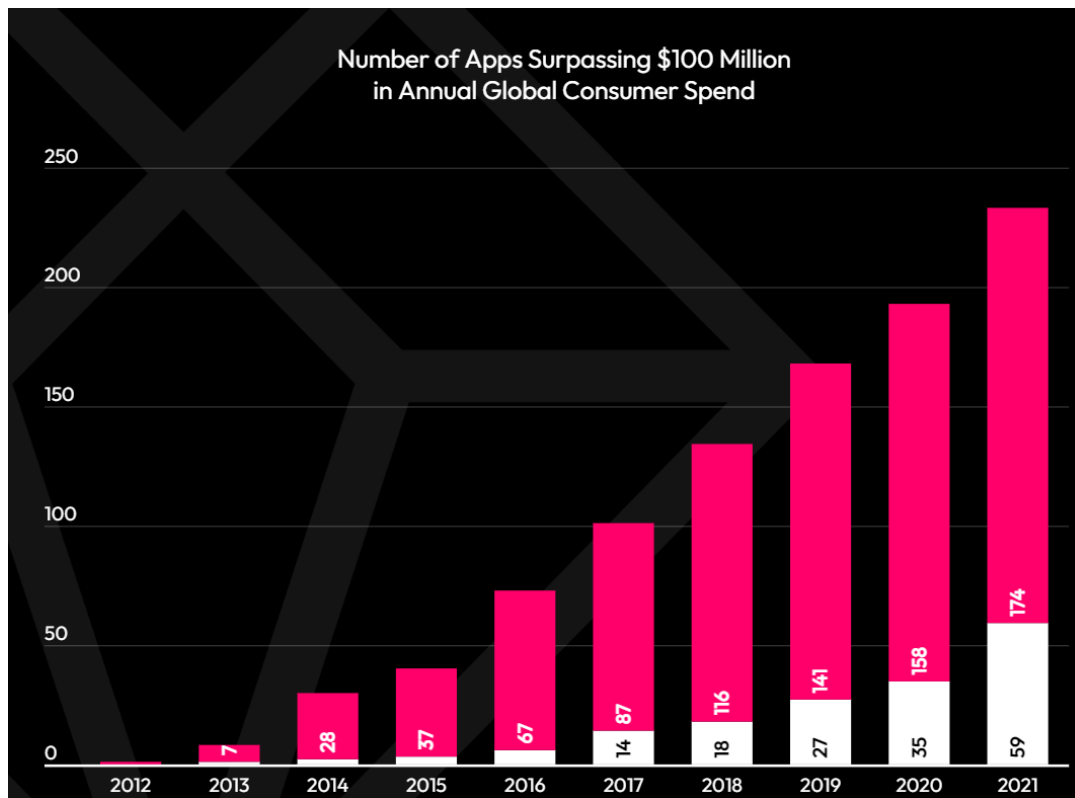
Direct and indirect revenues of the gaming industry. © Accenture

9.4 Mobile game consumer Spend Growth



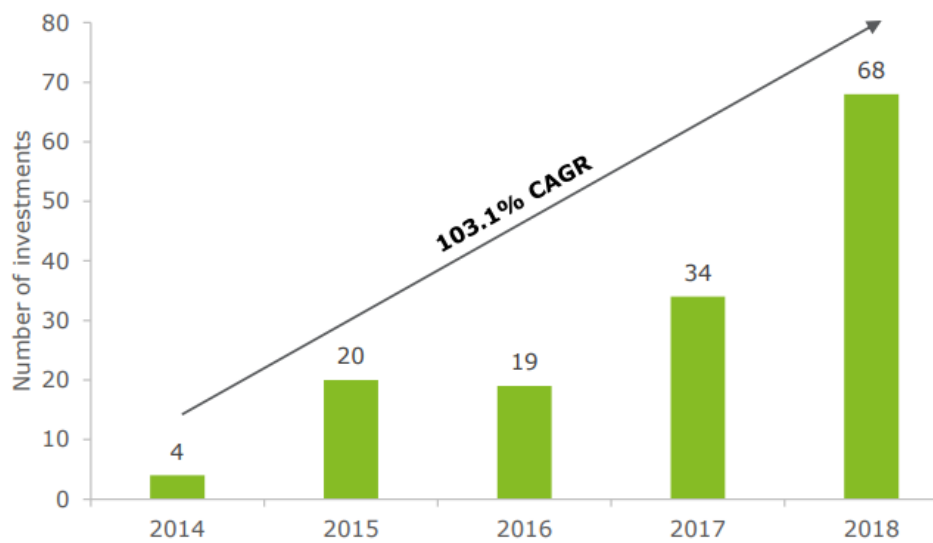
Mobile Game consumer Spend growth ©Data.ai

9.5 Number of Apps surpassing 100\$ million in annual global consumer spend



Number of Apps surpassing 100\$ million in annual global consumer spend ©Data.ai

9.6 Number of investments in Esport

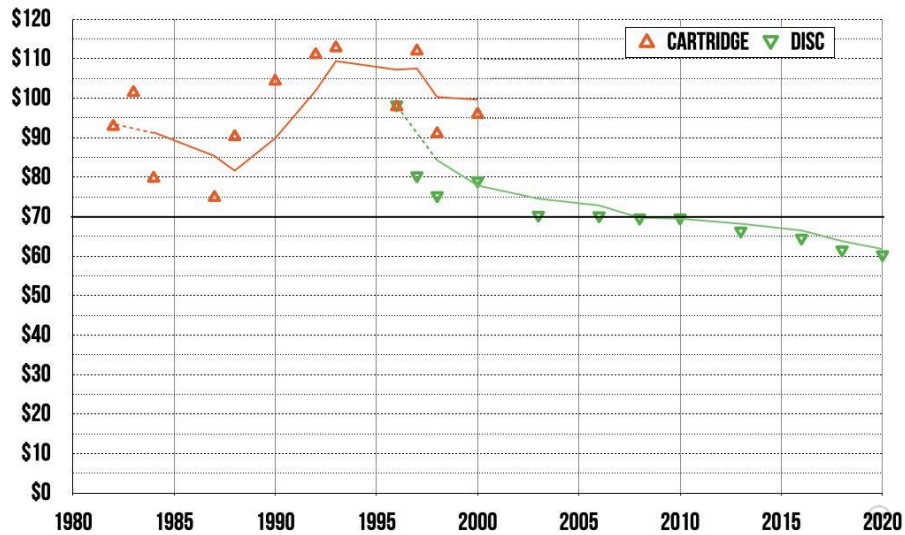


Number of investments in Esport ©Deloitte

9.7 Average inflation-adjusted prices for top-end video games

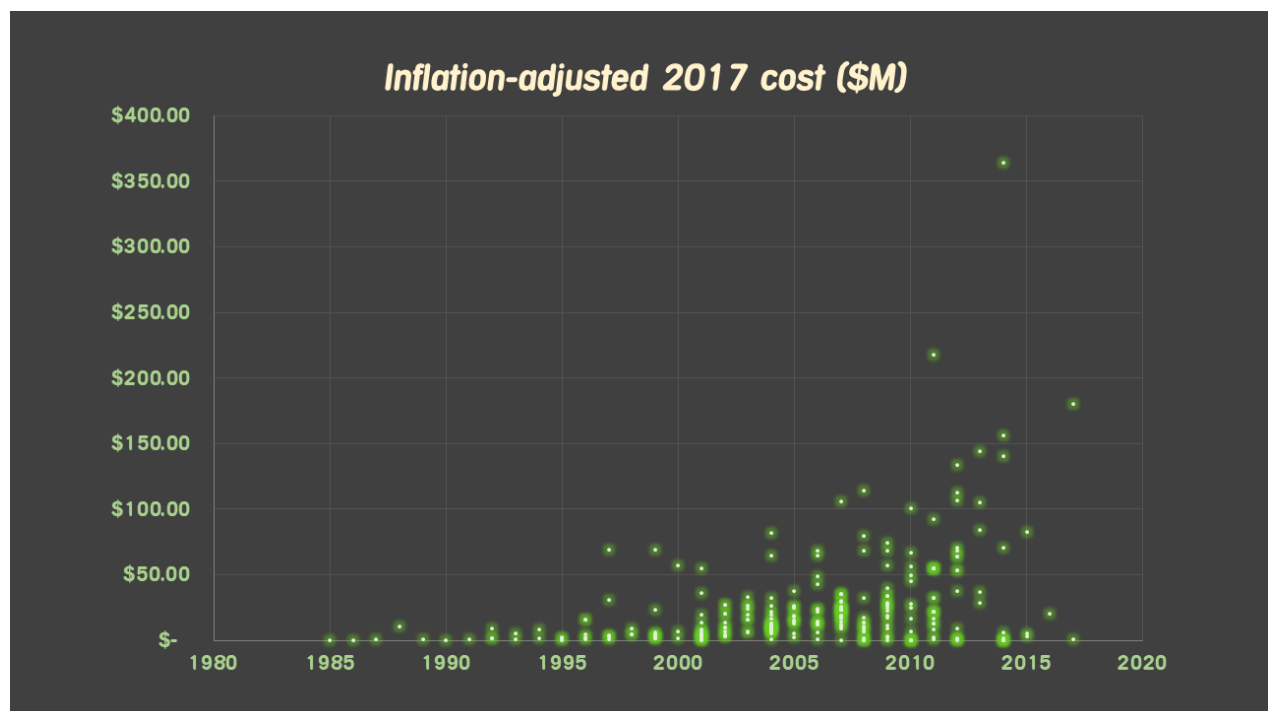
AVERAGE INFLATION-ADJUSTED PRICES FOR TOP-END VIDEO GAMES

2020 dollars



Average inflation-adjusted prices for top-end video games © ARS TECHNICA

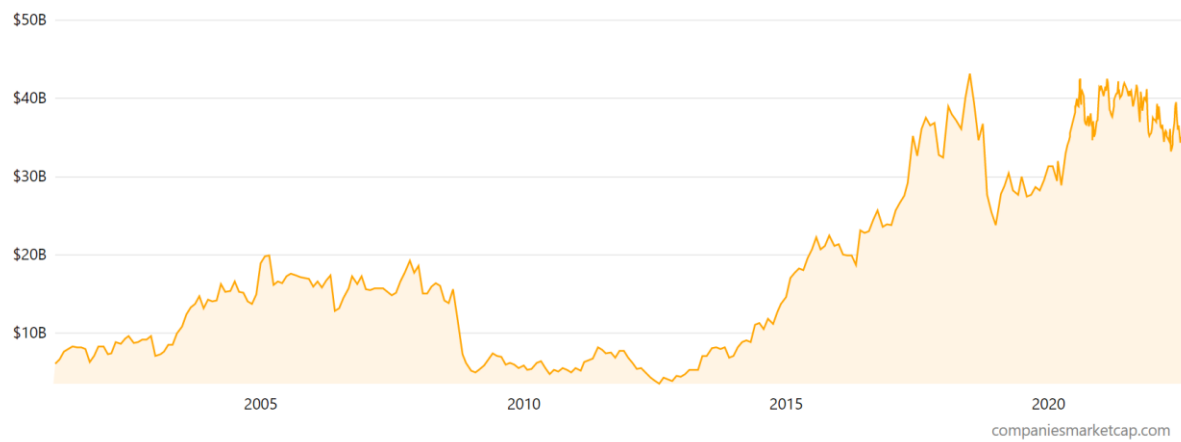
9.8 Inflation-adjusted 2017 cost in millions of dollars



Inflation-adjusted 2017 cost in millions of dollars ©Raph Koster

9.9 EA market capitalization

Market cap history of Electronic Arts from 2001 to 2022



Market cap history of Electronic arts from 2001 to 2022 ©companiesmarketcap.com

10. Appendix of the Methodology

10.1 Part 1 of the survey

Digital Ownership in the gaming industry

Hello everyone,

As part of my thesis at the Louvain School of Management in Louvain-La-Neuve (UCLouvain), I am conducting a study to get your opinion on digital ownership in the gaming industry.

There has been a lot of change over the past 20 years, but not just in the look and feel of the games. Throughout this millennium, we have seen significant changes in the types of games available, how we buy them and even how we play them. With almost \$300 billion worth of revenue, the gaming industry is poised for even further growth. The objective of this survey is to collect the opinions of as many players as possible. Whether you play every day or once a month, whether you play on console, PC or mobile you are invited to answer.

The questionnaire is only 2 pages and should take between 2 and 5 minutes.

Thank you in advance for your time and your answers

 maloul.remy@gmail.com (non partagé) [Changer de compte](#)



*Obligatoire

Are you a *

- ☐ Woman
- ☐ Man
- ☐ Other

What is your age range: *

- ☐ <18
- ☐ 18-24
- ☐ 25-35
- ☐ 36-50
- ☐ 50+

Among these answers, which one corresponds the most to your consumption in terms of time spent on video games per week? (all types of games included: mobile, PC, console) *

- ☐ Less than 1h
- ☐ 1 to 3 hours
- ☐ 3 to 6 hours
- ☐ 6-10 hours
- ☐ 10-20 hours
- ☐ 20+ hours per week
- ☐ Autre : _____

You play mainly on *

- ☐ Console
- ☐ PC
- ☐ Mobile
- ☐ Other

Have you ever purchased a physical and/or digital game? *

- ☐ Physical
- ☐ Digital
- ☐ Both
- ☐ Neither of the two

Have you ever downloaded a free-to-play game? *

- ☐ Yes
- ☐ No
- ☐ I don't know

What is your average monthly spend on video games? (software only) *

- ☐ 0
- ☐ 5 to 25\$
- ☐ 25 to 50\$
- ☐ 50 to 100\$
- ☐ 100 to 250\$
- ☐ 250 to 500\$
- ☐ More than 500\$

10.2 Part 2 of the survey

Among the following questions, give your opinion with a scale from 1 to 5 (strongly disagree to strongly agree) 3 representing neutrality

Digital ownership in the gaming industry is important to me *

1 2 3 4 5

Strongly disagree ○ ○ ○ ○ ○ Strongly agree

Do you think digital games should be owned by the buyers ? *

1 2 3 4 5

Strongly disagree ○ ○ ○ ○ ○ Strongly agree

Do you think we should be able to sell/lend/rent/trade our digital games? *

1 2 3 4 5

Strongly disagree ○ ○ ○ ○ ○ Strongly agree

Do you think your in-game purchases that are not consumable such as skins or characters should be the ownership of the person who buys it?

1 2 3 4 5

Strongly disagree ○ ○ ○ ○ ○ Strongly agree

Do you think we should be able to sell/lend/rent/trade our in-game purchases ? *

1 2 3 4 5

Strongly disagree ○ ○ ○ ○ ○ Strongly agree

Do you think online gaming accounts should be the ownership of whoever created them?

1 2 3 4 5

Strongly disagree ○ ○ ○ ○ ○ Strongly agree

Do you think we should be able to sell/lend/rent/trade our accounts on online video games?

1 2 3 4 5

Strongly disagree ○ ○ ○ ○ ○ Strongly agree

It is normal that games that allow you to sell digital items only allow you to do so * in exchange for credit that can only be used in their game/system/platform.

1 2 3 4 5

Strongly disagree ○ ○ ○ ○ Strongly agree

I am against in-game purchases that give advantages in-game *

1 2 3 4 5

Strongly disagree ○ ○ ○ ○ ○ Strongly agree

I am against in-game purchases which are purely cosmetic and do not offer any in-game advantages *

1 2 3 4 5

Strongly disagree ○ ○ ○ ○ Strongly agree

I am against in-game purchases that give the possibility to play new characters

1 2 3 4 5

Strongly disagree ○ ○ ○ ○ Strongly agree

In-game purchases should not be available and the entire game should be available directly upon purchase of the game

1 2 3 4 5

Strongly disagree ○ ○ ○ ○ ○ Strongly agree

You are interested in winning digital items in a game *

1 2 3 4 5

Strongly disagree ○ ○ ○ ○ ○ Strongly agree

If it were possible to earn digital items in a video game that could be sold/lend/rented/traded it would increase your engagement in the game. *

1 2 3 4 5

Strongly disagree ○ ○ ○ ○ ○ Strongly agree

In-game purchases should be better regulated *

1 2 3 4 5

Strongly disagree ○ ○ ○ ○ ○ Strongly agree

Loot boxes (random reward system in exchange of a certain price) in video games are a form of gambling *

1 2 3 4 5

Strongly disagree ○ ○ ○ ○ ○ Strongly agree

Loot boxes should be banned *

1 2 3 4 5

Strongly disagree ○ ○ ○ ○ ○ Strongly agree

I am interested in the use of blockchain in the gaming industry *

Strongly disagree 1 2 3 4 5 Strongly agree

I am interested in the use of NFT in the gaming industry *

Strongly disagree 1 2 3 4 5 Strongly agree

11. Appendix of the Statistical analysis

11.1 descriptive statistics

This table represents the descriptive statistics for questions Q1* to Q19* used in the hypotheses analyzed in this study

Descriptive statistics					
	N	Minimum	Maximum	mean	Standard deviation
Digital ownership in the gaming industry is important to me (Q1*)	458	1	5	3,84	1,255
Do you think digital games should be owned by the buyers ? (Q2*)	458	1	5	4,58	,872
Do you think we should be able to sell/lend/rent/trade our digital games? (Q3*)	458	1	5	3,95	1,265
Do you think your in-game purchases that are not consumable such as skins or characters should be the ownership of the person who buys it? (Q4*)	458	1	5	4,26	1,072
Do you think we should be able to sell/lend/rent/trade our in-game purchases ? (Q5*)	458	1	5	3,55	1,435
Do you think online gaming accounts should be the ownership of whoever created them? (Q6*)	458	1	5	4,44	,960
Do you think we should be able to sell/lend/rent/trade our accounts on online video games? (Q7*)	458	1	5	2,95	1,546
It is normal that games that allow you to sell digital items only allow you to do so in exchange for credit that can only be used in their game/system/platform. (Q8*)	458	1	5	3,17	1,258

I am against in-game purchases that give advantages in-game (Q9*)	458	1	5	4,51	1,015
I am against in-game purchases which are purely cosmetic and do not offer any in-game advantages (Q10*)	458	1	5	1,96	1,279
I am against in-game purchases that give the possibility to play new characters (Q11*)	453	1	5	3,13	1,402
In-game purchases should not be available and the entire game should be available directly upon purchase of the game (Q12*)	458	1	5	3,55	1,294
You are interested in winning digital items in a game (Q13*)	458	1	5	3,66	1,246
If it were possible to earn digital items in a video game that could be sold/lend/rented/traded it would increase your engagement in the game. (Q14*)	458	1	5	3,26	1,382
In-game purchases should be better regulated (Q15*)	458	1	5	4,16	1,056
Loot boxes (random reward system in exchange of a certain price) in video games are a form of gambling (Q16*)	458	1	5	4,43	,984
Loot boxes should be banned (Q17*)	458	1	5	3,44	1,456
I am interested in the use of blockchain in the gaming industry (Q18*)	458	1	5	2,13	1,342
I am interested in the use of NFT in the gaming industry(Q19*)	458	1	5	1,72	1,207

11.2 Hypothesis 1: correlation table

		Coefficients ^a				
		Non-standardized coefficients		Standardized coefficients		
Model		B	Standard error	Bêta	t	Sig.
1	(Constant)	1,259	,199		6,339	,000
	Q1*	-,013	,017	-,039	-,776	,170
	Q2*	-,001	,029	-,002	-,029	,395
	Q3*	,004	,020	,012	,192	,980
	Q4*	-,024	,024	-,061	-1,011	,249
	Q5*	,024	,018	,081	1,313	,911
	Q6*	,011	,023	,025	,490	,579
	Q7*	-,010	,015	-,035	-,658	,285
	Q8*	,018	,017	,053	1,072	,036
	Q9*	,024	,022	,058	1,105	,641
	Q10*	,036	,017	,109	2,074	,392
	Q11*	-,019	,016	-,065	-1,217	,384
	Q12*	,024	,019	,074	1,295	,776
	Q13*	,000	,019	-,001	-,016	,126
	Q14*	-,029	,017	-,095	-1,671	,103
	Q15*	-,026	,022	-,065	-1,169	,047
	Q16*	-,024	,024	-,056	-1,016	,023
	Q17*	-,008	,018	-,029	-,472	,063
	Q18*	,001	,021	,003	,043	,639
	Q19*	,006	,023	,016	,242	,791

a. Dependent variable: Are you a Man, Woman or other

b. * Represents the variables of the second part of the questionnaire from 1 to 19

11.2.1 Correlation equation

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,099 ^a	,010	,008	,319

a. Predictors: (Constant), It is normal that games that allow you to sell digital items only allow you to do so in exchange for credit that can only be used in their game/system/platform.

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,036	,041		25,311	,000
	It is normal that games that allow you to sell digital items only allow you to do so in exchange for credit that can only be used in their game/system/platform.	,025	,012	,099	2,108	,036

a. Dependent Variable: Are you a

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,094 ^a	,009	,007	,320

a. Predictors: (Constant), In-game purchases should be better regulated

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,235	,062		20,018	,000
	In-game purchases should be better regulated	-,029	,014	-,094	-1,990	,047

a. Dependent Variable: Are you a

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,107 ^a	,012	,009	,319

a. Predictors: (Constant), Loot boxes (random reward system in exchange of a certain price) in video games are a form of gambling

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,271	,070		18,286	,000
	Loot boxes (random reward system in exchange of a certain price) in video games are a form of gambling	-,035	,015	-,107	-2,283	,023

a. Dependent Variable: Are you a

11.3 hypothesis 2: correlation table

Coefficients^a

Model		Non-standardized coefficients		Standardized coefficients	t	Sig.
		B	Standard error	Bêta		
1	(Constant)	2,676	,424		6,319	,000
	Q1*	-,013	,036	-,017	-,349	,924
	Q2*	-,058	,062	-,055	-,943	,296
	Q3*	,074	,043	,101	1,717	,400
	Q4*	,137	,050	,159	2,727	,029
	Q5*	-,079	,038	-,124	-2,058	,420
	Q6*	,029	,048	,030	,603	,593
	Q7*	,060	,031	,101	1,940	,123
	Q8*	,004	,035	,005	,108	,706
	Q9*	-,046	,047	-,051	-,997	,971
	Q10*	-,029	,037	-,039	-,769	,470
	Q11*	,047	,034	,072	1,390	,377
	Q12*	-,039	,039	-,054	-,983	,854
	Q13*	-,060	,040	-,080	-1,501	,001
	Q14*	-,151	,037	-,227	-4,078	,000
	Q15*	,025	,047	,028	,521	,326
	Q16*	-,023	,050	-,024	-,450	,539
	Q17*	,032	,038	,051	,836	,110
	Q18*	,004	,045	,005	,083	,905
	Q19*	,076	,050	,098	1,532	,289

a. Dependent variable: What is your age range:

b. * Represents the variables of the second part of the questionnaire from 1 to 19

11.3.1 Correlation equation

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,102 ^a	,010	,008	,914

a. Predictors: (Constant), Do you think your in-game purchases that are not consumable such as skins or characters should be the ownership of the person who buys it?

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2,185	,175		12,484	,000
	Do you think your in-game purchases that are not consumable such as skins or characters should be the ownership of the person who buys it?	,087	,040	,102	2,189	,029

a. Dependent Variable: What is your age range:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,149 ^a	,022	,020	,909

a. Predictors: (Constant), You are interested in winning digital items in a game

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2,959	,132		22,465	,000
	You are interested in winning digital items in a game	-,110	,034	-,149	-3,224	,001

a. Dependent Variable: What is your age range:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,200 ^a	,040	,038	,900

a. Predictors: (Constant), If it were possible to earn digital items in a video game that could be sold/lend/rented/traded it would increase your engagement in the game.

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2,990	,108		27,693	,000
	If it were possible to earn digital items in a video game that could be sold/lend/rented/traded it would increase your engagement in the game.	-,133	,030	-,200	-4,355	,000

a. Dependent Variable: What is your age range:

11.4 hypothesis 3: correlation table

Coefficients^a

Model		Non-standardized coefficients		Standardized coefficients	t	Sig.
		B	Standard error	Bêta		
1	(Constant)	3,017	,551		5,475	,000
	Q1*	,049	,047	,051	1,042	,059
	Q2*	,066	,080	,048	,824	,019
	Q3*	,022	,056	,023	,392	,947
	Q4*	,087	,065	,078	1,340	,115
	Q5*	-,060	,050	-,072	-1,206	,189
	Q6*	-,062	,062	-,049	-,988	,969
	Q7*	,055	,040	,071	1,367	,396
	Q8*	-,001	,046	-,001	-,024	,739
	Q9*	,010	,061	,008	,159	,805
	Q10*	,068	,048	,072	1,411	,219
	Q11*	-,068	,044	-,079	-1,531	,173
	Q12*	-,044	,051	-,047	-,850	,676
	Q13*	-,024	,052	-,025	-,464	,097
	Q14*	-,073	,048	-,084	-1,510	,002
	Q15*	,060	,062	,053	,978	,149
	Q16*	-,044	,065	-,036	-,670	,619
	Q17*	,006	,050	,008	,126	,030
	Q18*	-,079	,058	-,087	-1,359	,000
	Q19*	-,156	,065	-,154	-2,418	,001

a. Dependent variable: What is your average monthly spend on video games? (software only)

b. * Represents the variables of the second part of the questionnaire from 1 to 19

11.4.1 Correlation equation

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,109 ^a	,012	,010	1,192

a. Predictors: (Constant), Do you think digital games should be owned by the buyers ?

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2,079	,298		6,972	,000
	Do you think digital games should be owned by the buyers ?	,150	,064	,109	2,346	,019

a. Dependent Variable: What is your average monthly spend on video games? (software only)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,141 ^a	,020	,018	1,187

a. Predictors: (Constant), If it were possible to earn digital items in a video game that could be sold/lend/rented/traded it would increase your engagement in the game.

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3,166	,142		22,239	,000
	If it were possible to earn digital items in a video game that could be sold/lend/rented/traded it would increase your engagement in the game.	-,123	,040	-,141	-3,050	,002

a. Dependent Variable: What is your average monthly spend on video games? (software only)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,101 ^a	,010	,008	1,193

a. Predictors: (Constant), Loot boxes should be banned

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2,480	,143		17,334	,000
	Loot boxes should be banned	,083	,038	,101	2,174	,030

a. Dependent Variable: What is your average monthly spend on video games? (software only)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,208 ^a	,043	,041	1,173

a. Predictors: (Constant), I am interested in the use of blockchain in the gaming industry

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3,163	,103		30,748	,000
	I am interested in the use of blockchain in the gaming industry	-,186	,041	-,208	-4,552	,000

a. Dependent Variable: What is your average monthly spend on video games? (software only)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,222 ^a	,049	,047	1,170

a. Predictors: (Constant), I am interested in the use of NFT in the gaming industry

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3,146	,095		32,972	,000
	I am interested in the use of NFT in the gaming industry	-,220	,045	-,222	-4,854	,000

a. Dependent Variable: What is your average monthly spend on video games? (software only)

11.5 hypothesis 4: correlation table

		Coefficients ^a				
		Non-standardized coefficients		Standardized coefficients		
Model		B	Standard error	Bêta	t	Sig.
1	(Constante)	1,365	,352		3,879	,000
	Q1*	,025	,030	,041	,846	,332
	Q2*	-,013	,051	-,015	-,257	,199
	Q3*	,019	,036	,031	,535	,507
	Q4*	,024	,042	,033	,575	,931
	Q5*	,044	,032	,081	1,372	,200
	Q6*	-,013	,040	-,016	-,330	,511
	Q7*	-,032	,026	-,063	-1,235	,550
	Q8*	,028	,029	,046	,970	,121
	Q9*	-,088	,039	-,114	-2,285	,002
	Q10*	-,004	,031	-,006	-,125	,036
	Q11*	-,012	,028	-,021	-,407	,011
	Q12*	-,059	,033	-,098	-1,798	,000
	Q13*	,073	,033	,117	2,223	,000
	Q14*	,056	,031	,100	1,823	,000
	Q15*	-,053	,039	-,072	-1,344	,000
	Q16*	-,095	,042	-,120	-2,281	,000
	Q17*	-,005	,032	-,010	-,161	,000
	Q18*	-,032	,037	-,055	-,861	,895
	Q19*	-,040	,041	-,062	-,983	,982

- a. Dependent variable: If yes, how much per month do you spend on in-game purchases?
- b. * Represents the variables of the second part of the questionnaire from 1 to 19

11.5.1 Correlation equation

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,148 ^a	,022	,020	,769

a. Predictors: (Constant), I am against in-game purchases that give advantages in-game

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,189	,164		7,255	,000
	I am against in-game purchases that give advantages in-game	-,113	,035	-,148	-3,190	,002

a. Dependent Variable: If yes, how much per month do you spend on in-game purchases?

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,098 ^a	,010	,007	,774

a. Predictors: (Constant), I am against in-game purchases which are purely cosmetic and do not offer any in-game advantages

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,795	,066		12,022	,000
	I am against in-game purchases which are purely cosmetic and do not offer any in-game advantages	-,059	,028	-,098	-2,100	,036

a. Dependent Variable: If yes, how much per month do you spend on in-game purchases?

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,119 ^a	,014	,012	,772

a. Predictors: (Constant), I am against in-game purchases that give the possibility to play new characters

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,884	,089		9,958	,000
	I am against in-game purchases that give the possibility to play new characters	-,066	,026	-,119	-2,547	,011

a. Dependent Variable: If yes, how much per month do you spend on in-game purchases?

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,179 ^a	,032	,030	,765

a. Predictors: (Constant), In-game purchases should not be available and the entire game should be available directly upon purchase of the game

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,060	,105		10,143	,000
	In-game purchases should not be available and the entire game should be available directly upon purchase of the game	-,107	,028	-,179	-3,879	,000

a. Dependent Variable: If yes, how much per month do you spend on in-game purchases?

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,197 ^a	,039	,037	,762

a. Predictors: (Constant), You are interested in winning digital items in a game

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,229	,111		2,075	,039
	You are interested in winning digital items in a game	,123	,029	,197	4,298	,000

a. Dependent Variable: If yes, how much per month do you spend on in-game purchases?

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,160 ^a	,026	,023	,768

a. Predictors: (Constant), If it were possible to earn digital items in a video game that could be sold/lend/rented/traded it would increase your engagement in the game.

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,386	,092		4,188	,000
	If it were possible to earn digital items in a video game that could be sold/lend/rented/traded it would increase your engagement in the game.	,090	,026	,160	3,462	,001

a. Dependent Variable: If yes, how much per month do you spend on in-game purchases?

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,172 ^a	,030	,028	,766

a. Predictors: (Constant), In-game purchases should be better regulated

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,206	,146		8,282	,000
	In-game purchases should be better regulated	-,127	,034	-,172	-3,734	,000

a. Dependent Variable: If yes, how much per month do you spend on in-game purchases?

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,155 ^a	,024	,022	,768

a. Predictors: (Constant), Loot boxes (random reward system in exchange of a certain price) in video games are a form of gambling

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,221	,166		7,366	,000
	Loot boxes (random reward system in exchange of a certain price) in video games are a form of gambling	-,122	,037	-,155	-3,348	,001

a. Dependent Variable: If yes, how much per month do you spend on in-game purchases?

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,166 ^a	,028	,025	,767

a. Predictors: (Constant), Loot boxes should be banned

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,983	,092		10,695	,000
	Loot boxes should be banned	-,089	,025	-,166	-3,595	,000

a. Dependent Variable: If yes, how much per month do you spend on in-game purchases?

11.6 hypothesis 5: correlation table

Coefficients ^a					
Model		Non-standardized coefficients		Standardized coefficients	Sig.
		B	Standard error	Bêta	
1	(Constant)	3,017	,551		,000
	Q1*	,049	,047	,051	,520
	Q2*	,066	,080	,048	,865
	Q3*	,022	,056	,023	,572
	Q4*	,087	,065	,078	,976
	Q5*	-,060	,050	-,072	,755
	Q6*	-,062	,062	-,049	,217
	Q7*	,055	,040	,071	,107
	Q8*	-,001	,046	-,001	,348
	Q9*	,010	,061	,008	,090
	Q10*	,068	,048	,072	,085
	Q11*	-,068	,044	-,079	,029
	Q12*	-,044	,051	-,047	,870
	Q13*	-,024	,052	-,025	,376
	Q14*	-,073	,048	-,084	,971
	Q15*	,060	,062	,053	,036
	Q16*	-,044	,065	-,036	,339
	Q17*	,006	,050	,008	,794
	Q18*	-,079	,058	-,087	,995
	Q19*	-,156	,065	-,154	,516

- a. Dependent variable: Average time spent per month in video games
- b. * Represents the variables of the second part of the questionnaire from 1 to 19

11.6.1 Correlation equation

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,103 ^a	,011	,008	1,307

a. Predictors: (Constant), I am against in-game purchases that give the possibility to play new characters

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4,132	,150		27,495	,000
	I am against in-game purchases that give the possibility to play new characters	,096	,044	,103	2,190	,029

a. Dependent Variable: Among these answers, which one corresponds the most to your consumption in terms of time spent on video games per week? (all types of games included: mobile, PC, console)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,098 ^a	,010	,007	1,307

a. Predictors: (Constant), In-game purchases should be better regulated

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3,929	,249		15,811	,000
	In-game purchases should be better regulated	,122	,058	,098	2,106	,036

a. Dependent Variable: Among these answers, which one corresponds the most to your consumption in terms of time spent on video games per week? (all types of games included: mobile, PC, console)

Abstract:

The objective of this master thesis is to study the feeling of digital ownership among gamers and the analysis of a new approach via the blockchain and non-fungible tokens.

While the emergence of video games took place in the mid-20s, it is only in the early 2000s that they are democratized and installed in our living rooms just like books, DVDs or music CDs. Some even consider the gaming industry as the cultural industry of the 21st century. Indeed, even though it has only recently emerged, its worldwide turnover generated twice as much revenue as the film and music industries combined in 2019. The development of video games is closely linked to the development of technology. With this evolution, video games have gradually left the physical world to join the digital world, leading to a change in our relationship to the ownership of our video game assets. While it used to be possible to exchange and even resell our video games, with the digitization of these, it has become almost impossible, making us lose our ownership of them. Add to this that the economic model of video games has changed over time, leading to the advent of "free-to-play" games but also the integration of microtransactions in almost all the new video games. Therefore, in addition to the question of the ownership of digital video games, there is also the question of our relationship to the ownership of the digital items within them. The fact that we no longer possess ownership of these assets cannot be disputed. Do video game players feel this loss of ownership? What is their point of view regarding digital ownership in the gaming industry? Are there any solutions to this issue?

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