**Related Literature Review**

1. **Technology observations**

The development of blockchain technology continues to be in its early stage of improvement. Don Tapscott and Alex Tapscott write a book entitled Blockchain Revolution: How the Technology Behind Bitcoin is Changing Money, Business, and the World contend that cryptocurrencies not just make international money transfers less difficult and more affordable but also make a way on how many people could benefit from it rather than few , and that blockchain may offer a more reliable way for us to store and exchange our cash and can change how our institutional sectors works. In that way, blockchain technologies are being used to transform the way we handle data in industries like financial institutions, healthcare and government sectors.

**Current state of Blockchain in the Philippines**

In the Philippines, the blockchain technology was initially introduced in 2009, and through time, it gained popularity there. According to the data collected by the  World Bank in 2021, the Philippines is the 36th-largest economy by nominal GDP and the third-largest economy in Asia. Despite its small size, the country  is considered to be one of the fastest-growing economies in the international market due to its transition from agricultural country to  services and industrialization. Also, as reflected in Chainalysis’s Global Crypto Adoption Index 2022, where it now ranks second, only behind its ASEAN neighbour, Vietnam.

 Over the past years, cryptocurrency became extremely popular in the Philippines due to its economic shift in digital assets. In fact, according to an article of Bitcoin (2018), The Philippines government-owned **Cagayan Economic Zone Authority (CEZA)** has partnered with Northern Star Gaming & Resorts Inc. to develop a crypto and fintech hub called **Crypto Valley of Asia (CVA**). Cryptocurrency is digital money, making it virtual and having no physical form. "**Crypto**" refers to the various encryption algorithms and cryptographic techniques that safeguard these entries, such as elliptical curve encryption, public-private key pairs, and hashing functions. It is purely digital, meaning it can be stored online and even in small, specially designed hardware.

According to the Finder Cryptocurrency Adoption Index  report in 2022,  Bitcoin (BTC) is the most popular cryptocurrency with over 36% crypto owners in the Philippines followed by Ethereum (ETH) and Dogecoin (DOGE). Additionally, as reported by the same adoption index,  the Philippines ranks 12th out of 26 countries for crypto adoption with over 11.6 million Filipinos owning digital assets.

|  |  |  |  |
| --- | --- | --- | --- |
| Popular Cryptocurrency | Symbol | What is it? | How does it work? |
| Bitcoin |  | The first cryptocurrency ever created was Bitcoin. Satoshi Nakamoto created it on October 31 and officially released it on January 3 of 2009. Three concepts can all be referred to as "Bitcoin":   * The digital currency, Bitcoin (BTC) * The Bitcoin blockchain * The Bitcoin network | Bitcoin is a decentralized digital money that is independent and does not use financial institutions and centralized authorities like government sectors. It uses peer-to-peer transfers and a virtual network that records all cryptocurrency trades. It is powered up by the blockchain, an open source code that couples up or links blocks of transaction histories to prevent tampering. |
| Ethereum |  | Vitalik Buterin introduced the world to Ethereum in a [2014 whitepaper](https://ethereum.org/en/whitepaper/). A year later, he and Joe Lubin launched the [Ethereum](https://ethereum.org/en/) blockchain, the decentralized, global software platform and open-source blockchain best known for its [smart contract](https://ethereum.org/en/smart-contracts/) functionality, which eventually led to its popularity for NFTs. Ethereum’s native currency is **Ether**, which is commonly abbreviated to ETH. Ethereum is the blockchain itself, while Ether (ETH) is the currency used to make transactions on the Ethereum blockchain. | Ethereum is a Layer 1 (often abbreviated as “L1”) blockchain, which means it executes and validates transactions independently without assistance. Ethereum facilitates everything from the buying, selling, and storing of NFTs to Decentralized Finance (also called “DeFi”). |
| Dogecoin |  | In 2013, Jackson Palmer and Billy Markus founded the open-source cryptocurrency known as Dogecoin. It is  an open-source, peer-to-peer cryptocurrency Dogecoin (DOGE). It is regarded as an alternative cryptocurrency and debuted in December 2013 with a Shiba Inu dog as its logo. | Dogecoin operates using blockchain technology. The goal of Dogecoin was to build a strong user base for an entertaining and simple use of Litecoin alternative, which is also an alternative to Bitcoin. It uses a proof-of-work consensus mechanism by the Dogecoin blockchain, in which miners use computers to execute transactions and log them on the blockchain by solving challenging mathematical problems. |

One good thing about cryptocurrency is that you can easily send your digital money to anyone, anytime, anywhere. As it works through blockchain technology.

**How do people earn in Cryptocurrency and NFTs**

According to the article of Moneymax (2022) “Bitcoin Guide: How to Buy Bitcoins in the Philippines”, Filipinos earn Bitcoins through the following:

1. **Buy Bitcoin on an Exchange**

* You may purchase, sell, or trade cryptocurrencies on exchange websites. You may immediately purchase Bitcoin using Philippine pesos on a number of exchanges, including Coins.ph, PDAX, Binance, and BloomX.
* It is designed for those new to cryptocurrency investing who just want to purchase Bitcoin for use in trading or investing. They may keep their money in the digital wallets and just wait for their value to rise.

1. **Earn Bitcoin by Mining**

* Bitcoin mining is an integral part of how bitcoin works. Mining is the process by which special bitcoin users (called miners) compete with each other to discover new bitcoins and add recent bitcoin transactions to bitcoin’s public ledger. In order to spend or receive bitcoins, a bitcoin user must create a transaction and broadcast it to the entire network, validate it and then, for this transaction to successfully go through, it must be permanently recorded on the block chain. A transaction block – a condensed record of all the transactions for that period of time.
* Miners used mining software like CGMiner, BFGMiner, MultiMiner, and Awesome Miner in order to get bitcoins. A proof-of-work scheme is  considerably using difficult mathematical problems that a miner must solve. In order to have a particular number of bitcoins and be rewarded for solving it, this proof-of-work system was intended to have solutions that are simple to verify but extremely difficult. The network adjusts its difficulty based on how quickly miners solve those math problems when each transaction has to be accepted or validated. *ASIC (Application-Specific Integrated Circuit Chips)* are made particularly for bitcoin mining to mine  faster. But over time, as more people adopted bitcoin mining, it became more difficult for individuals to solve math problems. As a result, they invented pooled mining, which combines the effort of miners to achieve a single objective. However, groups of miners work through mathematical problems more quickly than individuals and are equally rewarded.

1. **Receive Bitcoin as Payment**

* But if you’re still wondering where you can use your bitcoins, here’s some online and offline merchants that accept the cryptocurrency as payment in the Philippines:
  1. [Metrodeal](http://metrodeal.com/) & [CashCashPino](http://cashcashpinoy.com/)y-  the country’s top two daily deal sites – started [accepting bitcoin payments](https://www.techinasia.com/metrodeal-cashcashpinoy-accept-bitcoin-payments-coinsph/). This is one more payment option for customers, who are now not just limited to credit card and ATM payments.
  2. Wirin Cupcakery - is an online seller creating made-to-order cupcakes. It offers delivery within Metro Manila and customers can easily pay in bitcoin upon delivery.

According to the article of Bitpinas (2021) “Axie Infinity: Earn Money Playing Axie Infinity”, Filipinos earn Ethereum (ETH) through the following:

1. **Earn by Playing Axie Infinity**

* Axie Infinity, a Pokemon-inspired play-to-earn [metaverse game created](https://cointelegraph.com/blockchain-for-beginners/what-is-metaverse-in-blockchain-a-beginners-guide-on-an-internet-enabled-virtual-world) on [the Ethereum blockchain](https://cointelegraph.com/ethereum-for-beginners/architectural-components-of-the-ethereum-blockchain-what-are-they) and one of the popular block-chain based games and the game-changer or play-to-earn system  was created by Vietnamese video game developer Sky Mavis in 2018. The game contains creatures called "Axies" that players collect and use to duel other players and enemies. Every Axie is a Non-Fungible Token (NFT) , minted on the Ethereum blockchain that is adapted from the blockchain technology of Bitcoin and other Cryptocurrencies. As an evident on how cryptocurrencies become popular in the Philippines is the fact that based on the data from ActivePlayer.io, 40% of all the players of the popular [play-to-earn (P2E) game Axie Infinity](https://cointelegraph.com/news/monster-battle-nft-game-axie-infinity-soars-in-popularity-among-developing-nations) were from the Philippines. In fact, the game has also been a financial game-changer for [many citizens in the country](https://cointelegraph.com/news/axie-infinity-player-buys-two-houses-in-the-philippines-from-in-game-profits).

1. **Buy ETH**

* Buying and selling cryptocurrency in Coins.ph

According to Smart Trading (n.d.),  an example of online broker in the Philippines, Filipinos earn Dogecoin through the following:

1. **Buy and Sell**

* To buy Dogecoin in the Philippines, you should first choose an online broker like Smart Trading. The online broker will provide a trading platform for transactions. Then you need to go through a simple registration process on the platform, open and fund your account.

1. **Lending**

* You can lend Dogecoin in exchanges like Smart Trading

**Rules and Policy on Crypto and NFT**

In terms of mandated law, the government of the Philippines is still in the process of putting or establishing legal and comprehensive frameworks for the use of the blockchain technology and digital assets. However, The Bangko Sentral of the Philippines (BSP) has issued a *Circular No. 944 dated 06 February 2017* that defines *that:*

* *Virtual Currency  Exchanges are companies or businesses engaged in changing VCs into fiat currency (and vice versa).*
* *The act of converting VCs into Philippine money can facilitate payments and remittances.*
* *Circular 944 requires VC Exchanges to register with the BSP as remittance and transfer companies. They are also required to put in place adequate safeguards to address the risks associated with VCs. These include control measures to counter money laundering/ terrorist financing (ML/TF), technology risk management systems, and consumer protection mechanisms.*

Making blockchain and digital assets legal in the Philippines. Also,  the Digital Asset Token Offering (DATO) is a regulatory framework for the issuance of digital token in the Philippines that was created by Cagayan Economic Zone Authority (CEZA). DATO regulations govern acquiring and launching crypto assets, whether they are security or utility tokens. Token offerings are required to have proper offering documents and extensive disclosure of details surrounding the project, including certification from experts. The tokens will then be listed on the licensed “Offshore Virtual Currency Exchange” (OVCE).

In addition to this, BSP referred to cryptocurrencies as digital or virtual assets. Cryptocurrencies can be taxed as either ordinary or capital assets depending on their status as assets. Despite the lack of clear guidelines from the Bureau of Internal Revenue (BIR), investors should expect their income from dealing with cryptocurrency to be subject to taxation. In Philippine Interpretation Committee (PIC) Q&A 2019-02, the accounting treatment for cryptocurrency can follow the rules governing inventory or intangible assets.

* In Philippine Accounting Standard (PAS) 2, if cryptocurrency is treated as inventory, it may be considered ordinary assets subject to ordinary income tax, 12% VAT on the total amount of income.
* If your cryptocurrency appears as an intangible asset, you'll be taxed. It means that if you sell an intangible asset, you'll be taxed; the longer you hold the VCs longer then sell it, the lower your tax might be. If you hold your VCs for much less than a 12 months and eventually sell them, you'll have to pay a higher tax, that is equivalent to ordinary tax.

**Trends and Emerging Technologies**

A pilot program for a Central Bank Digital Currency (CBDC) will be started by the Bangko Sentral ng Pilipinas (BSP). The Project CBDCPh program intends to provide practical understanding of the fundamental facets of CBDC's nature and its implications for the nation's financial system.

The central bank of a country issues digital money known as CBDCs, which are regarded as obligations by that organization. There are two types of it,  wholesale CBDCs and retail CBDCs.

1. **Wholesale CBDCs** are only utilized by financial institutions in their dealings with central banks and other financial organizations. Contrary to central bank money, which may only be used during the central bank's operating hours, wholesale CBDCs are accessible 24/7.
2. **Retail CBDCs** are utilized by individuals, organizations, and small enterprises for regular transactions and cater to retail transactions.

The BSP's Project CBDCPh is an exploratory project that aims to give a thorough overview of the possible effects of CBDCs on the Philippine financial system. In order to overcome frictions in the present national payment system, notably in the areas of safety, efficiency, and reliability, Project CBDCPh aims to identify important CBDC characteristics such as:

1. **Anonymity -** A token-based CBDC can be designed to provide anonymity, although the extent can be managed given the concerns regarding money laundering and terrorism financing.
2. **Transfer mechanism-** CBDCs can be transferred through a peer-to-peer basis or through an intermediary, such as a central bank, third-party agent, or commercial bank.
3. **Limits or caps -** A limit or cap can be implemented on the holdings of CBDCs to mitigate its potential adverse impact on certain sectors of the economy.
4. **Availability -** CBDCs could be made available 24 hours a day, seven days per week and not limited to the opening hours of a central bank.

According to  BSP Governor Benjamin E. Diokno (2021), the pilot is a major step for both the BSP and the Philippine financial industry towards understanding the potentials and risks of a wholesale CBDC.  Given that the vast majority of people still rely substantially on cash, the BSP has declared that it is uncertain that it will create its own Central Bank Digital Currency in the near future. BSP will keep an eye on local and international CBDC developments.

Built on the IBM Blockchain Platform, this supply chain finance solution from UnionBank will be available to all their customers and partners who will join the blockchain network. Aside from this, according to IBM (2018), The UnionBank, one of the largest banking organizations in the country, is working together with IBM on a blockchain-based solution that has the potential to reinvent supply chain finance by enhancing security, transparency and operational processes. Once a part of the network, all parties involved in a transaction can act on the same shared ledger, with each party updating only their part of the process — ensuring efficiency, consistency, trust and transparency, while safeguarding sensitive information.

In conclusion, examining the growing popularity of blockchain technology in Philippine markets and across the globe reveals its huge potential for revolutionizing a wide range of industries, where it can result in improved overall efficiencies and lower costs due to strengthened digital safety protocols along with enhanced operations that facilitate transparency. The Philippines have already made advancement in integrating these technologies into several fields.

**II. Technology Literature Reviews**

In today's fast changing technology scene, staying up to date on the newest breakthroughs and their repercussions is critical. Through performing a series of Technology Literature Reviews (TLRs), this study attempts to provide a thorough overview of the current status of technology. This study tries to investigate the achievements, trends, and impacts of technology across numerous areas by diving into diverse sources of literature, including scholarly papers, industry reports, and expert analyses. The research attempts to find essential insights, emerging topics, and research gaps by an in-depth examination of relevant literature, ultimately contributing to the body of knowledge in the field of technology.

**1. Studies and Statistics about Cryptocurrency**

**1.1. STUDY**

According to the article of Yi Su**,** cryptocurrency, powered by blockchain technology, offers several advantages in the financial sector. Its finite supply ensures rarity, while decentralized control by programmers and math increases trust. The use of blockchain allows users to own their personal data, reducing security costs. Cryptocurrency protocols provide rules for applications within their environments, with consensus mechanisms ensuring the integrity of transactions. Asymmetric encryption safeguards the blockchain and provides secure account control. However, it is important to recognize that cryptocurrency technology is not immune to security risks and privacy concerns. Overall, cryptocurrency has the potential to revolutionize the financial landscape with its secure, decentralized, and efficient features.

**1.2. STATISTICS**

1. **How many people use cryptocurrency?**

In recent years, cryptocurrency has grown in popularity. By 2021, there will be over 300 million bitcoin users worldwide. This equates to approximately 3.9% of the population owning some sort of cryptocurrency. Furthermore, thousands of establishments accept cryptocurrency payments. These figures are projected to rise as more businesses see the significance of the industry.

1. **Bitcoin holds about 66% of the total market share in the economy.**

Bitcoin accounts for around 66% of the overall value of the cryptocurrency market. Other cryptocurrencies have attempted to compete, but none have succeeded. Bitcoin had a market share of 100% when it initially started, and it had roughly 86% in 2015. This shows that other currencies are gradually displacing it.

**2. Studies and Statistics about NFT**

**2.1. STATISTICS**

Studies and statistics on NFTs provide insights into their popularity and impact. Researchers analyze market trends, user behavior, and the influence of NFTs on industries like art and gaming. These studies examine market size, transactions, artist earnings, buyer demographics, and implications for digital ownership. Stakeholders can gain a better understanding of NFT opportunities and challenges through these research findings.

Let us have a look at the NFT statistics and interesting facts in a detailed manner below.

1. **The Largest NFT Marketplace is OpenSea** OpenSea is the largest P2P marketplace for Non Fungible Tokens, with a total trading volume of roughly $14.68 billion. OpenSea takes 90% of all the NFT trading volume.

OPenSea recorded an all-time high trading volume of $3.7 billion in January 2022. The brand has also aided in the creation of a number of other competitors, like Axie Infinity, which is currently valued at $3.94 billion. The CryptoPunks ($2.40 bil.) and the NBA Top Shot ($0.78 bil.) are two more well-known markets.

Below is the overview of Top Marketplaces for NFTs  


1. **Thailand is the country with the most NFT users.**

Thailand is home to 5.65 million NFT users in the world. Brazil and the United States stand in the second and third spot with 4.99 million and 3.81 million users, respectively.

Below is the table showing the top 10 countries with the most number of NFT users:

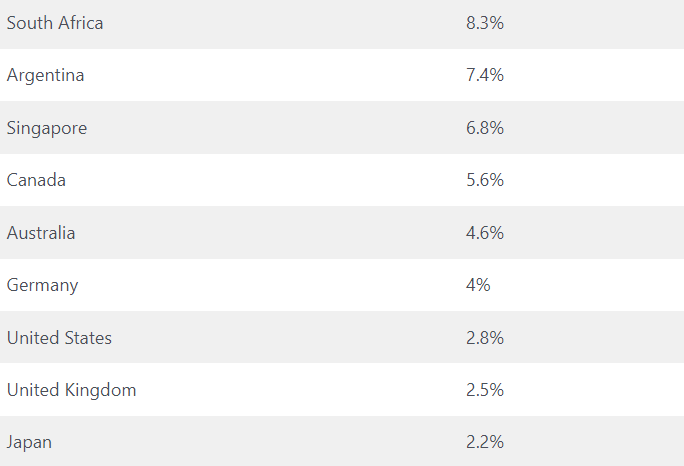
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1. **The Philippines is the country with the highest NFT adoption rate.**

According to Statista, individuals in the United States, United Kingdom, Canada, and Germany were substantially less likely to own or purchase NFTs in 2022 than people in other countries. Analyzing the results of multiple Google Surveys conducted in 2022 worldwide demonstrates that NFTs are highly popular among Southeast Asian and Latin American folks.

Here is a table showing the countries with the highest NFT adoption rate:





**2.2. STUDY**

Based on the research study by Dalai, S., it can be concluded that cryptocurrency, particularly in the form of non-fungible tokens (NFTs) and blockchain technology, has several positive aspects. Firstly, NFT trading practices were seen as a means to generate additional income by the majority of users. This highlights the potential financial benefits of participating in the cryptocurrency market. NFTs have provided individuals with opportunities to monetize their digital assets and creations, such as artwork, music, or collectibles, by leveraging the uniqueness and scarcity that non-fungibility offers. Secondly, the study indicates that ownership of NFTs can empower individuals by creating ownership structures. By utilizing blockchain technology, NFTs enable verifiable ownership and provenance of digital assets. This empowers creators and collectors by providing them with a sense of control and security over their digital possessions, which was previously challenging to achieve in the digital realm.

Additionally, the study emphasizes the importance of incorporating utility factors and utilizing smart contracts to maximize the value and effectiveness of NFTs. Smart contracts, which are self-executing contracts with predefined rules encoded on the blockchain, enable various functionalities and possibilities for NFTs. This programmability enhances the versatility and usefulness of NFTs beyond simple ownership, potentially leading to new and innovative applications.

Overall, the research suggests that cryptocurrency, particularly NFTs and blockchain technology, has the potential to bring financial opportunities, empower individuals through ownership structures, and leverage utility factors through smart contracts. However, it is important to note that the cryptocurrency market is still evolving, and caution should be exercised while participating in it due to its inherent volatility and potential risks.

**3. Advantages and disadvantages of blockchain**

Blockchain technology has garnered popularity due to its promise to transform businesses through decentralized and transparent transactions. Blockchain, with its distributed ledger maintained by a network of computers, has both advantages and disadvantages. In the framework of this discussion, we will look at its effectiveness as well as potential problems, as well as provide insights into the implications and influence of blockchain across numerous industries.

**Advantages:**

1. **Enhanced Security and Privacy**

Blockchain enhances data security and privacy by creating an unchangeable and encrypted record, safeguarding sensitive information from fraud and unauthorized access. Personal data can be anonymized and access can be restricted through permissions, addressing privacy concerns. Distributed storage across a network of computers makes it challenging for hackers to access data, reducing the risk of unauthorized breaches.

1. **Smart Contracts and Automation**

Transactions can also be automated using "smart contracts," increasing efficiency and speeding up the process even more. When certain requirements are met, the next stage in the transaction or process is automatically initiated. Smart contracts eliminate the need for human intervention as well as reliance on third parties to ensure that contract requirements are honored. Smart contracts and automation in blockchain provide advantages by reducing the need for intermediaries, and increasing efficiency through automatic execution of predefined conditions, resulting in faster and more reliable transactions.

1. **Increased efficiency and speed**

Traditional paper-intensive processes are time-consuming, prone to human error, and frequently necessitate third-party intervention. Blockchain can handle transactions far faster than traditional techniques since it eliminates intermediaries and replaces remaining human processes in transactions. In some circumstances, blockchain transactions can be completed in seconds or less.

Disadvantages:

1. **High costs of implementation**

Implementing blockchain in a business is expensive. Most businesses are hesitant to engage in this technology because of the high cost of capital. If you are a business owner interested in implementing blockchain, you must engage core blockchain developers as well as blockchain software developers. This will necessitate a significant investment. Following that, you must develop blockchain-based applications. There are further hardware requirements.

1. **Scalability Challenges**

Scalability issues confront blockchain technology, particularly in public and permissionless networks. The network may get slower as the quantity of transactions increases, resulting in longer confirmation periods and higher transaction costs. Solving scalability concerns while maintaining decentralization is a fundamental technological barrier to mainstream blockchain implementation.

1. **Immutability**  
    Data immutability has always been one of the biggest disadvantages of the blockchain. Once information is entered on a blockchain, it cannot be modified. Any inaccuracies or facts simply cannot be updated. This might cause issues with data accuracy, privacy compliance, and legal duties, especially when working with personal or secret information. In scenarios when data needs to be updated or corrected owing to changes in circumstances or legal requirements, the inability to readily amend or remove data might cause issues.

These are the main advantages and disadvantages of Blockchain technology. It is a game-changing method of storing and transporting data. While it has some drawbacks, most of them can be mitigated with proper design and implementation. Because of the current state of blockchain technology, it is the ideal fit for organizations who wish to use its distributed ledger capabilities.

**Surveys and Technology Evaluation and benefits**

This following collection of case reports explores a range of NFT and crypto investments, showcasing both successful ventures and instances of risk and scams. By examining these cases, the researchers aim to gain valuable insights into the opportunities and challenges present in this technology.

**Successful NFT and Crypto Investments**

**Case I:  Erik Finman – Strategic Investment on Cryptocurrency**

Erik Finman, known as the "Bitcoin Teenage Millionaire," made a remarkable investment journey starting at the age of 12. He convinced his parents to let him forgo college and pursue a non-traditional education if he could turn $1,000 into $1 million. Erik chose to invest the entire amount in Bitcoin and other cryptocurrencies when their value was just $12 per coin.

His decision paid off when the price of Bitcoin surged to $1,200 per coin two years later. Taking advantage of his success, Erik made a minor investment in an online education startup called Botangle by selling a portion of his crypto holdings. Investors showed interest in the platform, which provided video tutoring services, and offered him the choice to sell the company for either $100,000 or 300 BTC.

To win the bet with his parents, become the youngest cryptocurrency millionaire, and avoid attending college, Erik decided to accept the payment in Bitcoin. He achieved his objective by the time he turned 18, as the value of Bitcoin reached $2,700 in June 2017.

Erik's current estimated net worth is $5 million or more. In 2019, he launched Metal Pay, a website that educates people of all knowledge levels on Bitcoin investment. Overall, Erik Finman's case exemplifies the potential for success in the cryptocurrency market through strategic investment and entrepreneurial ventures.

**Case II:  Luis Buenaventure - Embracing Digital art through NFTs**

Luis Buenaventura, a Filipino artist and crypto entrepreneur, has emerged as one of the most successful NFT artists in the Philippines. His collaborations and artworks have garnered significant attention and success in the NFT space.

One of Luis' notable achievements was his collaboration with Argentinian comic book legend Jose Delbo. They sold 222 editions of their comic book art titled "Satoshi The Creator - Genesis" on the Nifty Gateway platform, each priced at $1,999, totaling over P22 million .Another notable collaboration was with Heart Evangelista and Rodel Colmenar resulting in a multimedia project that earned 17.35 ETH (approximately P3.6 million).

Luis' success as an NFT artist can be attributed to his early involvement in the cryptocurrency industry and his ability to adapt to the evolving NFT market. He emphasizes the importance of understanding cryptocurrency and being comfortable with investing in it. Additionally, he highlights the significance of creating cool, edgy, and unique art pieces that capture the attention of the NFT community. Scarcity, rarity, and promoting one's work in the crypto community, particularly on Twitter, are also crucial factors in achieving success as an NFT artist. Overall, Luis Buenaventura's journey in the world of NFTs showcases the possibilities and opportunities available for artists who embrace digital art and leverage the blockchain technology behind NFTs.

A picture containing fictional character, cartoon, action figure, fiction

Description automatically generated

*Figure 1. Satoshi The Creator – Genesis*

**Risks and Scams in Crypto Space**

**Case III: Ronin Bridge – Highlighting Importance of Decentralization**

In late March, the Ronin sidechain, built for the game Axie Infinity, was hacked, resulting in the theft of over 173,600 Ether (ETH) and 25.5 million USD Coin (USDC), with a combined value of over $600 million. The breach was attributed to the compromise of private keys to five validator nodes on the Ronin chain, including a third-party validator run by Axie DAO. The hackers gained access to four out of the nine validators, which is the threshold required to approve a transaction (Prashant, 2022).

The exploit was facilitated by social engineering and human error, as access granted by Axie DAO to Sky Mavis, the developers of Axie Infinity, was not revoked. Sky Mavis, the company behind Axie Infinity, pledged to reimburse and recover the stolen funds.

The hack raised questions about the security and decentralization of the Ronin chain, as well as the validator approval process. In the context of the Ronin bridge, decentralization refers to the distribution of power and control among multiple entities, reducing the risk of a single point of failure or vulnerability.

The Ronin bridge was designed with a limited number of validators, specifically nine validators, responsible for approving transactions and maintaining the integrity of the network. However, the problem arises when a significant portion of these validators is controlled by a single party, in this case, the developers behind Axie Infinity and the Axie DAO.

By having a majority of validators controlled by a single entity or a small group of entities, the system becomes more centralized. This means that if an attacker gains access to or compromises a significant number of these validators, they can potentially manipulate the network's operation and carry out fraudulent activities, as was the case with the Ronin hack.

The hack on the Ronin chain highlights a combination of human error and social engineering *(manipulation of individuals or groups through psychological tactics to deceive, manipulate, or gain unauthorized access to sensitive information or systems)*. It also exposed potential weaknesses in the design and decentralization of the system. While blockchain technology itself is not to blame, it is crucial to implement robust security practices and continuously improve the system to protect against potential vulnerabilities and attacks.

**Case IV: McGlay – Highlighting the Volatility of Cryptocurrencies**

During the cryptocurrency boom of the pandemic, Gian Carlo McGlay, A Filipino migrant worker, saw potential in Axie Infinity, a blockchain-based online game that allowed players to earn cryptocurrency called smooth love potion (SLP). McGlay formed a team of players, known as scholars, who rented game characters from managers like him in exchange for a portion of their earnings.

 At its peak, the game attracted millions of users, mainly from the Philippines and other developing countries. However, as crypto prices crashed, McGlay faced losses of over 1 million pesos, considering his Axie Infinity assets worthless. Many managers and players experienced similar financial setbacks as the value of SLP tokens plummeted from the highest peak which is P20 to P0.13. Consequently, the game's popularity also declined, and players moved on to other income sources. The volatile nature of the crypto world, as demonstrated by the SLP’s ups and downs, serves as a warning for potential investors (Philippine Daily Inquirer, 2023).

On the other hand, From an interview of Cruz (2021) to Joseph Louie Miranda, a crypto trader and Axie Infinity player, emphasized the presence of skepticism towards cryptocurrencies. Miranda encouraged people to educate themselves about cryptocurrencies and understand how they work before dismissing investments like Axie Infinity as scams. Miranda compared cryptocurrency investments to the stock market, explaining that their value increases due to people investing in them. He acknowledged that investing in anything involves evaluating risks, and in the case of Axie Infinity and other cryptocurrencies, risks can never be eliminated due to their volatile nature (Cruz, 2021).

Significantly, the case of SLP and other cryptocurrencies’ volatility is not the fault of blockchain technology itself. Since the volatility of cryptocurrency prices is driven by various factors such as market demand, investor sentiment, regulatory changes, and overall market conditions. These factors can cause significant price fluctuations in cryptocurrencies, including Axie Infinity's SLP which is independent of the underlying blockchain technology (Reiff, 2022).

**Effects of Cryptocurrency and NFT on several areas**

Cryptocurrencies and non-fungible tokens (NFTs) have brought about several impacts and effects across various domains. These effects are evident on the cases featured above and are allowed by the underlying blockchain technology. Here are some key effects of cryptocurrency and NFT:

**POSITIVE EFFECTS**

**1.**      **ECONOMY AND FINANCE**

**1.1 Financial Innovation:**

Cryptocurrencies have sparked innovation in the financial industry by introducing new forms of digital currency. They have challenged traditional banking systems and provided alternative means of transacting, storing value, and raising capital. A study from Gowda & Chakravorty (2021) summarizes that cryptocurrency transactions are better compared to bank transaction, but it is not aged or experienced as much as banks.

**1.2 Disintermediation**:

By leveraging blockchain technology, cryptocurrencies and NFTs eliminate the need for intermediaries such as banks, brokers, or record-keepers. This disintermediation reduces transaction costs, enhances transparency, and empowers individuals to have direct control over their financial assets and digital creations.

**1.3 Investment Opportunities:**

Investors can buy and trade various cryptocurrencies, and NFTS, potentially benefiting from price fluctuations and market trends. In fact, Cryptocurrency markets have skyrocketed in value over the past decade, at one point reaching almost $2 trillion. As of April 2023, Bitcoin was valued at more than $540 billion in crypto markets. However, it's important to note that cryptocurrency investments carry risks, including volatility and regulatory uncertainties (Frankenfield, 2021).

**2.**      **ART AND OWNERSHIP**

**2.1 Art and Digital Creativity:**

NFTs have revolutionized the art world by enabling digital artists to tokenize and sell their creations as unique, verifiable assets. This has created new opportunities for artists to monetize their work by selling their work directly to collectors, bypassing traditional intermediaries such as galleries or auction houses and traditional market value. Furthermore, NFT marketplaces provide global exposure for artists, making it easier for them to gain recognition and expand their reach. (Gruter, n. d.).

**2.2**    **Authenticity and Proof of Ownership:**

NFTs solve the problem of provenance in the art world. Each NFT contains a digital record of ownership and transaction history, ensuring the authenticity and provenance of the artwork. This transparent and immutable nature of blockchain technology helps combat issues such as art forgery and theft. (Gruter, n. d.).

**2.3 Ownership and Fractionalization:**

Cryptocurrencies and NFTs have introduced the concept of fractional ownership to the art market. It allows investors to invest in high-value or rare assets that may have been unaffordable by investing only fractions or shares of high-value artworks. It also provides liquidity, as fractional owners can sell or trade their ownership shares in secondary markets. (Gruter, n. d.).

**2.4 Royalty Streams for NFT Artists**

NFT technology also enables artists to earn royalties on their work, allowing them to receive a percentage of each subsequent sale of the token after the initial sale. When an artist creates an NFT and sells it, they can include a royalty clause in the smart contract associated with the NFT. This royalty clause specifies a percentage of the resale price that the artist will receive every time the NFT is sold in the future. This empowers creators to benefit from the long-term value of their art and incentivizes them to continue producing and sharing their creations (Gruter, n. d.).

**NEGATIVE EFFECTS**

**3.**      **MARKET AND INVESTMENTS**

**3.1 Market Volatility:**

                The volatility of cryptocurrencies can create a highly risky market environment. Prices can fluctuate rapidly, leading to significant gains or losses for investors. This volatility can make it challenging for artists and creators to determine the value of their NFTs and can also lead to financial risks for buyers and sellers (Reiff, 2022).

**3.2 Market Saturation:**

                The increasing popularity of NFTs has resulted in a flood of digital assets being created, which can make it harder for individual artworks to stand out. This saturation of the market can make it challenging for artists to get noticed and earn money from their creations. A new type of inequity in the art world may emerge for those artists who lack the tools and networks required to produce and market NFTs (Finance Magnates, 2023).

**4.**      **SECURITY**

**4.1 Hacking and Theft**

                Though cryptocurrency blockchains are highly secure, off-chain crypto-related key storage repositories, such as exchanges and wallets, can be hacked. Many cryptocurrency exchanges and wallets have been hacked over the years, sometimes resulting in millions of dollars worth of "coins" stolen, the same case with the Ronin bridge hacking. Hackers employ various techniques such as phishing attacks, malware, and exploiting software vulnerabilities to gain unauthorized access to these repositories. (Reiff, 2022).

**5.**      **ENVIRONMENT**

**5.1 Huge Energy Consumption**

                One of the advantages of cryptocurrencies is that anyone can mine them using a computer with an Internet connection. However, mining popular cryptocurrencies require considerable energy, sometimes as much energy as entire countries consume.

                For instance, Bitcoin, the largest cryptocurrency, has a significant impact on global energy consumption. Its annual energy consumption is estimated at 150 terawatt-hours, surpassing the electricity usage of entire countries like Argentina. This energy consumption emits around 65 megatons of carbon dioxide annually, comparable to the emissions of Greece. The growth of cryptocurrency mining operations has fueled an increasing demand for energy as companies compete to capitalize on the digital gold rush. The energy consumption of Bitcoin is a significant concern, and projections suggest that crypto miners could add up to 6 gigawatts of energy demand by mid-2023 (Hinsdale, 2022).

                Bitcoin mining involves solving complex mathematical puzzles to validate and add new transactions to the blockchain. This requires powerful computational hardware (mining rigs) to perform numerous calculations per second. The computational power required for mining increases over time, leading to higher energy demands. Cryptocurrency proponents say this problem can be solved using renewable energy; El Salvador’s president has pledged to use volcanic energy to mine Bitcoin, for example. Environmental concerns reportedly prompted Ethereum’s move to a proof of stake model, which uses less energy (Berman & Siripurapu, 2023).

It's worth noting that the impact and effects of cryptocurrencies and NFTs are still evolving, and their long-term implications on various sectors, including finance, art, and environment are still being explored. As these technologies continue to progress, their true potential and impact will become more apparent.

**Summary**

The research focuses on exploring the applications and functionality of blockchain technology in the context of cryptocurrency and NFTs, specifically within the Philippines. It aims to evaluate the use and impact of blockchain in cryptocurrency transactions and storage, as well as the production, trading, and verification of NFTs in the market. The study seeks to provide insights into the practical implications and benefits of blockchain technology in the specified areas, without extensively analyzing global blockchain landscapes or technical protocols.

Blockchain technology has had a transformative impact on transactions and data management. It gained popularity with the introduction of Bitcoin in 2009. Blockchain's security, immutability, and decentralization have benefited industries like finance, supply chain, and healthcare. In the Philippines, blockchain has driven growth and innovation, particularly in cryptocurrency adoption. The future of blockchain and cryptocurrencies in the Philippines appears promising, with growing interest and exploration of their applications in the financial infrastructure.

Blockchain technology is a decentralized digital ledger used for cryptocurrency and NFT trading. It offers transparency, security, and persistence of transactions while allowing some anonymity. Its architecture includes nodes, transactions, blocks, chains, miners, and consensus algorithms. Blockchain ensures decentralization, auditability, transparency, and security through cryptography. It can be implemented as public, private, or consortium blockchains. Consensus algorithms validate transactions. Research on blockchain includes exploring its history, uses, and functions, analyzing its significance in cryptocurrency and NFTs, and assessing its impact and benefits.

Blockchain technology also offers several advantages, including enhanced security, transparency, and efficiency in recording and verifying transactions. It enables decentralized and secure digital transactions, ensuring the integrity of data through cryptography. Additionally, blockchain's ability to automate processes using smart contracts contributes to increased efficiency and reduced costs. However, there are also disadvantages to consider, such as the high implementation costs and scalability challenges in public networks.

The collection of case reports explores the opportunities and challenges of cryptocurrencies and NFTs. Successful investment cases demonstrate the potential for significant returns and entrepreneurial ventures in this market. However, security risks, market volatility, and the saturation of the NFT market are concerns. Cryptocurrencies and NFTs have brought financial innovation and disintermediation, but also pose risks. It is important for individuals to educate themselves and make informed decisions. Improvements in security, decentralization, and environmental sustainability are needed for the long-term viability of cryptocurrencies and NFTs.