**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:

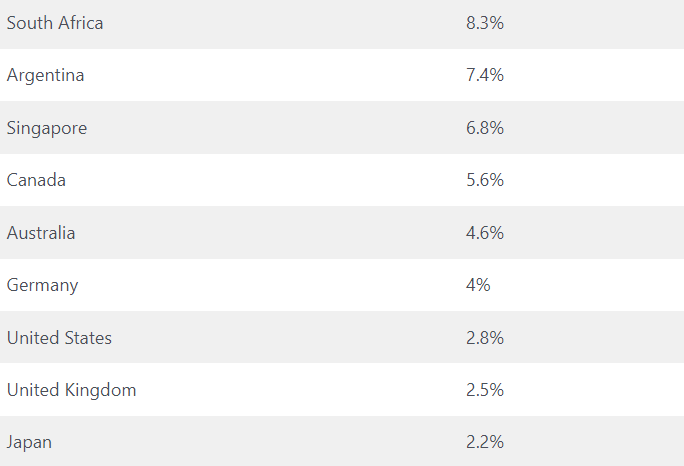
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1. **The Philippines is the country with the highest NFT adoption rate.**

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.