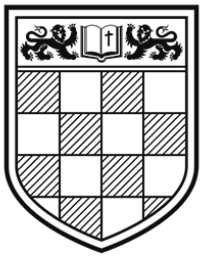

UNIVERSITY OF
WINCHESTER

What are the impacts and opportunities of blockchain technology and cryptocurrencies on global economic and political infrastructures?

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Major Research Project

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Abstract

Blockchain technology is a remarkable 21st century computing innovation. This study will investigate how blockchain technology can improve economic and political infrastructure, whilst determining whether lack of public knowledge and awareness of the technology is restricting its development and integration into these infrastructures. Cryptocurrencies are an application that use this innovative new technology. The waves these applications ripple across the economic world puts them at the forefront of this digital phenomenon, enabling the applications to pin public attitudes regarding them onto blockchain technology as a whole. Possible integrations of this new technology have been assessed, justified, and concluded to have enormous potential, and the likelihood of blockchain integration into economic and political systems over the next decade is proven guaranteed.

A summarised discussion has been formulated to assess the public attitudes towards blockchain technology and cryptocurrencies, using relevant case studies and literature to analyse and justify the use of the technology, whilst elaborating on illegitimate claims made by participants of a distributed survey for the purpose of rectifying public opinion surrounding it.

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1 Introduction

This paper focuses on two recently emerged digital innovations: blockchain technology and cryptocurrencies. The paper aims to analyse the impacts and opportunities, whilst assessing the benefits and limitations, of cryptocurrencies and blockchain technology on the global economic and political infrastructure, including the obstacles surrounding the nature of these technologies when considering their integration into society. In order to determine these factors, one must first understand exactly what the blockchain is and how it operates.

1.1 The principles of blockchain technology

It is a common perception that cryptocurrencies are the blockchain however this is untrue. Cryptocurrencies are a separate entity, but they do rely on blockchain technology and its fundamentals. The blockchain is a reimagined way of storing and distributing data. This paper will focus primarily on the public blockchain, rather than others like a private blockchain or permissioned blockchain, although references and comparisons may be made to these for the purpose of context. A public blockchain is an incorruptible, immutable, and distributed digital ledger (Wessel, 2016). The security of the blockchain is made up of three key principles.

1.2 Principle 1: Decentralisation

The theoretical beginning of blockchain began in 1991 when Stuart Haber and Scott Stornetta wanted to discover a way of authenticating digital documents, verifying that a digital document had not been amended from its original. Stornetta breaks down how the decentralisation of the blockchain works: *"I realised that if you… created a system of interlinked documents with essentially everyone as a witness, then you had, in fact, solved the problem" (Stornetta, 2021).* This idea is one of the principles of blockchain security. The way in which this idea is used is entirely unique and what enables the blockchain to operate. The blockchain puts the idea of everyone being a witness into practice. It is run by thousands of independent computers referred to as 'nodes' that uphold all the data on the blockchain (Bitnodes, 2022). These nodes each have a complete copy of all the data on the blockchain (they all witness the same data), so if one node fails/malfunctions, the rest still have the data and continue operating (**see figures 1, 2, & 3**). If a node is designated as malicious or sends conflicting data to the blockchain (data that does not match the data on all other nodes) it is essentially kicked out of the blockchain, because with blockchain technology, the majority always wins. This use of millions of independent nodes is what makes the blockchain 'decentralised', meaning the blockchain is not controlled by any central authority, it is controlled by consensus decisions of the majority of nodes.

Figure 1 - Traditional Economic Communication.

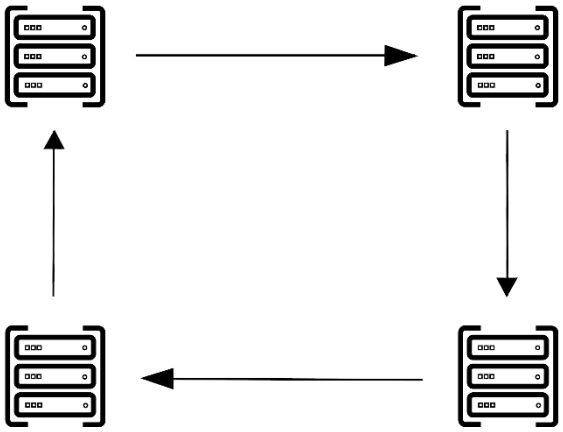


Figure 2 - System breaks down when one computer fails, requires immediate maintenance.

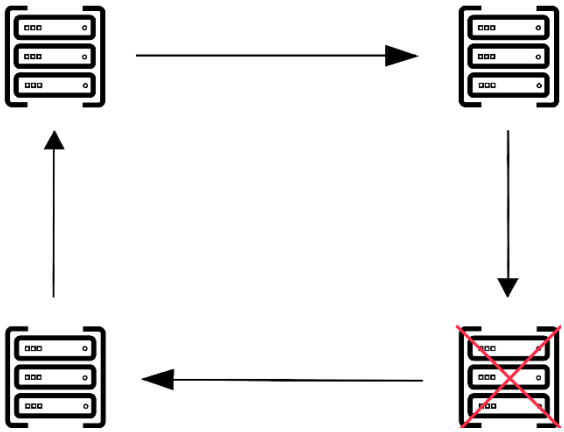
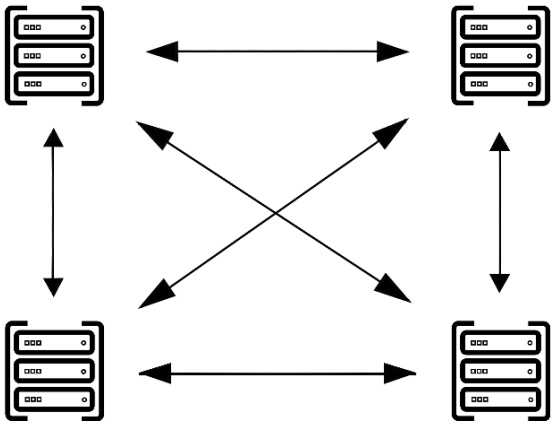


Figure 3 - The idea of the blockchain ecosystem is if one computer fails, the connection still continues.



1.3 Principle 2: Cryptography

The second security principle of the blockchain is cryptography. Derived from the ancient Greek terms *kryptos* meaning 'hidden' and *graphein* meaning 'to write', it is the most fundamental principle of blockchain security. To understand cryptography, one must first understand the hash algorithm, more specifically the SHA-256 algorithm. The SHA-256 algorithm is used to scramble data/information when transferring it from one place to another. SHA-256 scrambles the data from plain-text (readable information) into a 256-bit ID that is incomprehensible, as it is made up of random letters and numbers. This is referred to as a 'hash'. Hashing is a one-way function; therefore, it cannot be reverse engineered. This ID is embedded onto the information like a lock. SHA-256 is used within the blockchain to encrypt, the way in which it is decrypted is different.

The blockchain uses two types of cryptography; hashing, as described above, and also the use of an 'asymmetric key'. An asymmetric key is created through an RSA algorithm. The algorithm generates a 'public' and 'private' key that are mathematically linked with each other. If one party wants to send information/data to another, they exchange the details of one another's public keys (**see figure 4**), then the sender encrypts the data they are sending with the recipient's public key, so that when the recipient receives the information, the public key corresponds to their private key, which they use to decrypt and view the data (**see figure 5**).

Figure 4 - Patrick and Louise share public keys.

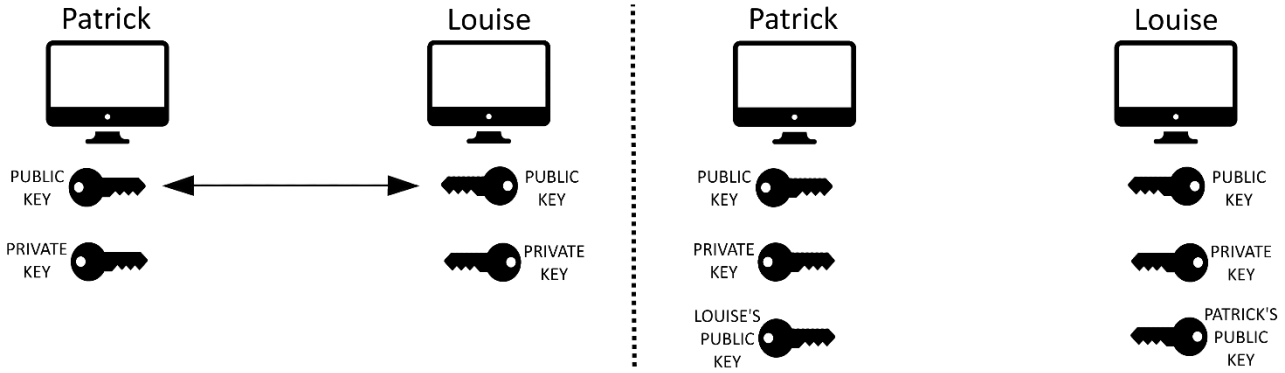
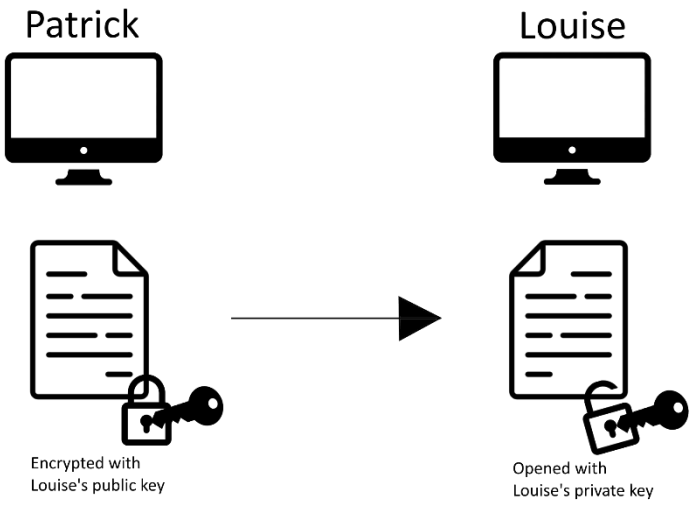


Figure 5 - Patrick secures data using SHA-256 and encrypts it with Louise's public key.

Louise opens the data using her private key that is linked mathematically with her public key.



1.4 Principle 3: Consensus Mechanisms

In order for the blockchain to be reliable and stable, consensus mechanisms are put in place. Consensus means to have a majority universally agree on a matter, the mechanism is the route or solution to get there. To verify the transactions of data on the blockchain, the majority of nodes need to all agree on whether the data is valid and should be added to the ledger. To explain this, the consensus mechanisms for the Bitcoin blockchain and the Cardano blockchain will be broken down. Although there are a number of consensus mechanisms, only these two will be explored. This is because they are the only ones that have been tested to a significant scale and proven to be successful.

The Bitcoin consensus mechanism is called proof-of-work (PoW). It is essential that all nodes have the same ledger with the same data to ensure transactions are valid, to prevent double spending, and to uphold the stability of the blockchain. PoW is an algorithm that uses a consequential amount of effort to detect and eliminate fake and malicious uses of computer power. When a new block of data is created, millions of 'miners' (operators of nodes) use their combined computing power to guess the password to the new block. The one who guesses correctly has to verify the data on the block, for example verifying that there is no evidence of double spending. This verification results in everyone's ledger being updated with the latest verified block of data. To incentivise miners to perform this task the Bitcoin blockchain rewards them with a certain amount of bitcoin. Misbehaviour from a miner on a PoW mechanism results in their node being cut off from future mining. It is only possible to create fraudulent transactions if an individual, group, or organisation has more computing power than 51% of the other nodes, thus making them the majority, allowing them to dictate the blockchain.

The Cardano blockchain uses an alternative to PoW called proof-of-stake (PoS). PoS is similar to PoW however it has an embedded punishment mechanism to prevent inefficiency and malicious miner activity. PoS designates specific volunteer validators (miners) to guess the password to the block, rather than all miners competing with all their computer power at the same time. These validators stake a specific amount of their cryptocurrency. This means if they do not verify the block (due to equipment inadequacy or other) or attempt malicious activity, the cryptocurrency they staked will be 'slashed' resulting in them losing it, similar to a security deposit. This is to ensure people validating blocks are reliable, ethical, and trustworthy.

1.5 Overview

The principles of blockchain technology have been broken down for context to enable understanding of points and suggestions that are made in the results and evaluation section of this paper, as well as any other relevancies in alternative sections. Using this knowledge, this paper will explore the impacts and opportunities of blockchain technology and cryptocurrencies on global economic and political infrastructures. Their advantages and disadvantages will be analysed and evaluated to come to a justified conclusion on whether we may see these technologies integrated into our society, either minimally or significantly. The likelihood of these integrations will be weighed up by the significance of their ability to change society for good, or for worse.

1.6 Thesis statement

What are the potential benefits and limitations of integrating blockchain technology into economic and political infrastructures, and is the extent of public knowledge and awareness regarding this technology hindering it's integration. The primary areas investigated within this paper are:

- Advantages and disadvantages of blockchain technology.
- Key obstacles facing blockchain technology integration.
- The reliability of blockchain security principles

1.7 Aims and Objectives

The aims of this paper are to analyse the potential of blockchain technology for economic and political systems, whilst also assessing how public opinion may hinder the integration of these potentials.

The objectives are:

- To assess and present the advantages and disadvantages of blockchain technology.
- To distinguish the difference between blockchain technology and cryptocurrencies.
- To review the key obstacles facing blockchain technology integration.
- To positively elevate public knowledge, awareness, and attitudes of blockchain technology and cryptocurrencies.
- To inform on the risks of cryptocurrencies

1.8 Structure

This report consists of 6 chapters:

Chapter 1 is the introduction. The purpose of this chapter is to provide focus, crucial context, and a perspective of what's to come.

Chapter 2 is the literature review. This chapter seeks to analyse, justify, then evaluate existing credible and academic sources. The literature review provides important contextual information that helps the reader understand the subject matter of the paper.

Chapter 3 is the methodology. This chapter outlines how research was conducted, through different types of data analysis. The purpose of this section is to justify and show the research design, whilst referencing compliance with ethical standards and procedures.

Chapter 4 details the research findings. This chapter presents the findings of research conducted in relevance to the aims and objectives. Quantitative data received is presented and described.

Chapter 5 is the discussion. This chapter compares results from the research findings to relevant literature from the literature review chapter. The comparisons are created to fulfil the aims and objectives of the paper.

Chapter 6 is the conclusion of the paper. The purpose of the conclusion is to reaffirm the focus and value, as well as asserting new directions for the research to proceed to.

Following the final chapter is the appendices, presenting the data from the primary research, and a reference list.

2 Literature Review

Blockchain technology is a digital innovation still in its infancy. Although it is young, the possibilities of the technology to change the way in which the financial and logistical world works are enormous. As an example of the magnitude, the blockchain could account for up to 10% of global GDP by 2025 according to the WEF (World Economic Forum, 2018). The principles of the blockchain lay a robust foundation for alternative digital innovations such as cryptocurrencies. The technologies' security and reliance must be investigated to the highest standard, to assure trust in their operations. The purpose of this literature review is to assess existing information and data on the security principles of blockchain technology, whilst assessing the hurdles it must overcome to become integrated into society. The aim is to come to an evaluated and justified conclusion on whether blockchain technology and cryptocurrencies are likely to be implemented into institutions, organisations, and society in general, whilst exploring what this could mean for the next decade of global development.

2.1 Investigating blockchain security principles

The security of the blockchain can be argued as the sole reason for its success. This section will breakdown these security principles using literature from credited academic sources in order to maximise the legitimacy of claims made for and against the technology.

2.1.1 Decentralised nature

Since the early days of computing, theories and arguments have been made highlighting the significance surrounding reliabilities within a computer system. In 1983, a paper was released detailing an abstract problem with computer systems; their absolute reliance on one another. The paper is called '*The Byzantine Generals Problem*' (Lamport, 1983). The paper puts forward a scenario in which there are several Byzantine divisions that are distanced apart with a general commanding each one. The problem is one of these generals is a traitor and can send conflicting messages to the other division generals that can sabotage the whole operation. The logic of this problem is applied to the issue regarding the reliance of computer systems on others to distribute and uphold valid information. Within a blockchain, computer nodes work in unison to help each other uphold the network. Using a scenario of excess energy; residential solar panels may produce more power than required, this excess energy could be rerouted to help supply the grid or be stored in external batteries (like an electric car). This configuration demonstrates the consumer operating as a node to help manage supply and demand across the system (Calma, 2021). The argument of computer reliance is solved by blockchain technology because it does not have a categorical reliance on any one computer system or central authority. As said previously, it is upheld by a network of computers

around the world that all have the same data, therefore inaccuracies are quickly compared to that of the majority of computers to flush them out, therefore making the data trustworthy.

The Byzantine Generals Problem implies that in order for the operation to function correctly and efficiently, all loyal generals (computers in context to this paper) *must* decide upon the same plan of action. How might one achieve this? The solution proposed within the paper is that "every general must obtain the same information". The decentralised nature of the blockchain means it cannot be manipulated and overwritten, thus demonstrating its secure infrastructure. The information distributed among all computers is the same, proving blockchain technology solves the problem of computer reliance put forward by Lamport, Shostak, and Pease.

2.1.2 Cryptographic nature

Blockchain technology uses cryptography to securely send information and data. The possibility of being able to crack the security of the blockchain is almost impossible as a result of the enormous computing power required to guess a SHA-256 hash function. The SHA-256 algorithm converts readable data into an unreadable, fixed 256-bit long sequence of randomised letters and numbers. SHA-256 is defined as a 'one way' function which means the hash cannot be reverse engineered to show the data being transferred (K.N. and Bhakthavatchalu, 2019). The reliability of this function is conveyed through the U.S. government's requirement for its agencies to protect sensitive or confidential information using this algorithm (Computer Security Division, Information Technology Laboratory, National Institute of Standards and Technology, U.S. Department of Commerce, 2015). In the eyes of computer science SHA-256 is *not* encryption, it is a function, as it is not classed as a method of encryption because there is no method of decryption (K.N. and Bhakthavatchalu, 2019). Instead, SHA-256 acts as a cloak to disguise data, and the use of asymmetric keys are the methods of encryption and decryption.

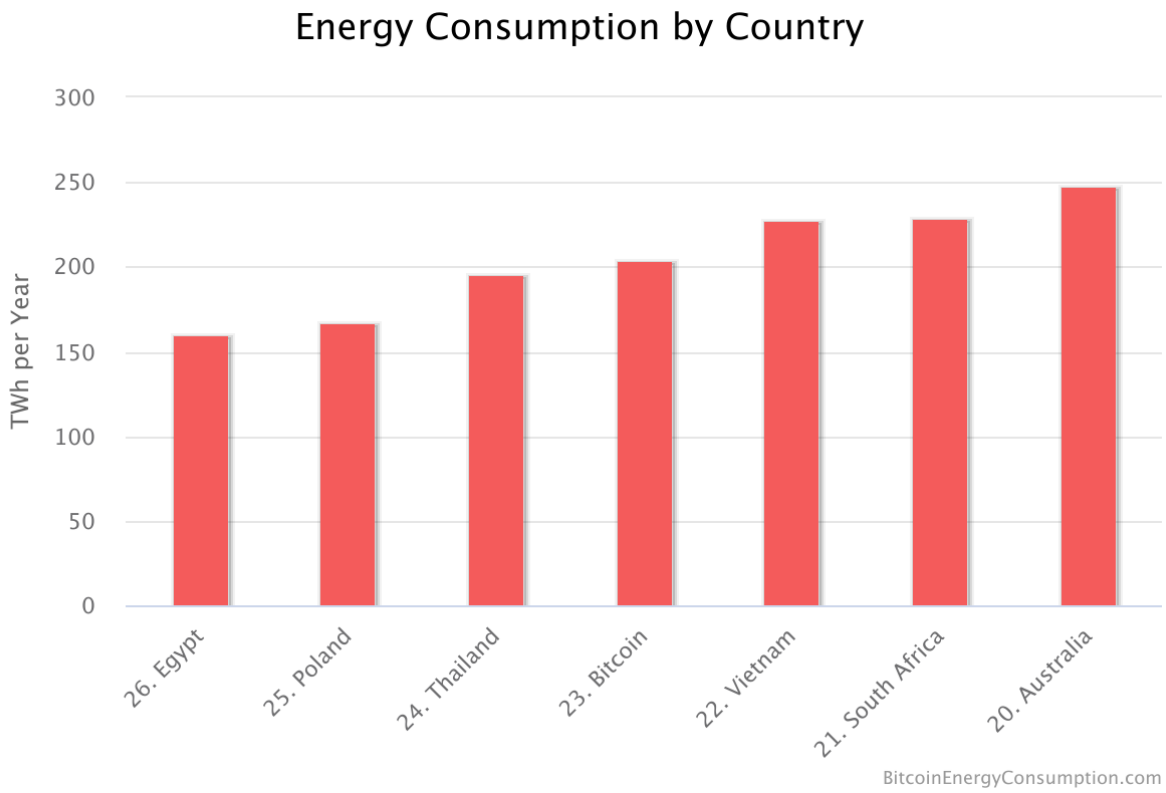
The asymmetric keys are the encryption and decryption mechanisms. These public and private keys each are made up of 64 randomised letters and numbers (256 bits). What would it take to guess the correct 256 bit key? Given it is only the private key that is confidential, as the public key is already viewable, this explanation will use symmetric key statistics as a basis for figures shown. The only practical way a malicious actor can obtain the private key is through a brute force attack (guessing). To guess a singular 256-bit private key, it would take 2.29 multiplied by 10^32 years using a computer that can comprehend that amount of computation (National Academies of Sciences, Engineering, and Medicine, 2019). This theoretical computer would require 6681 logical qubits of processing power, the current most advanced quantum computer has just 127 qubits (IBM, 2021). This computer would need 52x more processing power, even then it would take 2.29 x 10^32 years;

for perspective purposes, the estimated age of the universe is only 1.38 x 10^10 years old (National Science Foundation, 2020).

The drawback of this incredibly secure cryptographic system is the power usage through the mining process. Bitcoin uses more electricity per year than Norway, Poland, and is on track to surpass Egypt. Recorded in April 2022, Bitcoin consumes 151.01 TWh annually (Cambridge Centre for Alternative Finance, 2022). The CBECI (Cambridge Bitcoin Electricity Consumption Index) is an ongoing study which updates every 24 hours by a team at the University of Cambridge. The accuracy of their hypothetical electricity estimate is based off of a techno-economic 'bottom-up' model, where they theoretically calculate the lower and upper bound estimates. Through analysis of the methodology, the lower bound means the theoretical minimum total electricity expenditure and is calculated through the assumption that all miners always use the most energy-efficient equipment available on the market. The upper bound is the opposite, in which miners always use the least efficient hardware available, showing the theoretical maximum total electricity expenditure. As it is impossible to calculate exactly how much electricity Bitcoin consumes, due to the spontaneous number of people beginning mining each day, the index makes an average estimate based off of the data from both the upper and lower bound. Based off of the methodology they provide, this is the best possible estimate of Bitcoin electricity consumption, as it considers the difference in efficiency of hardware, a significant factor of electricity expenditure.

The problem surrounding this is not so much about how much energy it uses, it's about how this energy is produced i.e., nuclear power plants, coal etc. Vast quantities of Bitcoin mining occurred in China. Although China enacted a ban on cryptocurrency activity as of writing this paper, the data for the non-renewable energy usage demonstrates the need for a cleaner means of electricity production, as 40% of crypto mining within the country was assumed to be powered by coal, therefore reflecting negatively on cryptocurrencies (Jiang et al., 2021). Coal is currently the largest source of energy in the world, but also arguably the 'dirtiest' form of energy due to the substantial amount of health and environmental complications it causes such as premature death, heart problems, enormous carbon emissions and many more (Journal of Sustainable Mining, 2018).

Figure 6 - Alternative estimates have put the energy consumption of Bitcoin at just over 200 TWh per year (stats as of April 2022.)



2.1.3 Democratic nature

The blockchain brings democracy to database technology, and with it, the potential to mitigate corruption and fraud. Consensus mechanisms offer incentive for good behaviour and thus enables the blockchain to operate in a trustworthy manner. The use of proof-of-work (PoW) and proof-of-stake (PoS) mechanisms eradicate the need for a third-party validator for transactions such as a bank, which often always charge a fee. Decisions and commitments made to the blockchain are democratically installed through the acceptance by 51% of nodes (Aponte-Novoa et al., 2021). If the majority agrees that a transaction of data is valid and has no inaccuracies, then the block of valid data is added to the blockchain. If the majority does not agree, the data on the block that is inaccurate or fraudulent is thrown out.

How does the blockchain determine whether the data is accurate and not fraudulent? The nodes trace back through the history of the blockchain to determine whether the data is true or false. For example, if someone wanted to pass through a transaction that stated they were given 10 bitcoins, the nodes would analyse the history of the blockchain database to pinpoint exactly where those

bitcoins came from, right to the moment of their creation (to prevent malicious activity such as fraud and double spending) and come to a consensus on whether that transaction is legitimate, otherwise it is discarded/deleted from the blockchain. However, the computational cost to run the consensus mechanisms is ultimately what can bring impactful and damaging legislation to blockchain technologies and hinder its development.

Developers of blockchain technologies are aware of the overwhelming power consumption, and therefore introduce new attributes and rules to make it more energy efficient. An example of energy efficiency was the introduction of PoS, which major cryptocurrencies like Ethereum are gradually shifting to, through their imminent announcement of Ethereum 2.0 (Cryptopedia, 2021). PoS is the primary alternative to PoW, what makes it different is the significant difference in energy consumption. PoW tasks all miners on the blockchain to find the hash to the block, thus rewarding the winner. Miners compete in a frenzy for who can find the hash to the block first, resulting in them being rewarded for their efforts. Although all the miners compete to discover the correct hash to the block, only one miner gets the prize, therefore all other computing power used is essentially a waste of electricity and costs the miner money. With PoS, a miner stakes their cryptocurrency to be put in a draw to become a validator, rather than every miner on the network mining freely at the same time, consuming vast quantities of energy. This method of staking is set to be introduced in Ethereum 2.0 known as the *casper protocol*, to bolster trust in miners and encourage honesty (Kane et al., 2021).

A limitation and concern regarding blockchain technology, particularly public blockchains, is whether a malicious individual, group, or organisation can acquire more than 51% of the nodes. This would make them the majority, enabling them to double-spend/forge tokens thus devaluing the currency. This would enable them to dictate the blockchain as a central authority, defeating the idea of decentralisation, thus making that blockchain a corrupt democracy. The probability of this occurring is dependent on the computing power of a blockchain. A 51% attack, as it is often named, came close to reality with Bitcoin in 2014 when GHash.io, a consortium of Bitcoin miners, briefly accounted for more than 51% of the mining pool (The Guardian, 2014), stoking fears of an attack that sent the market share of GHash.io mining within the Bitcoin network from 42% to 28%, after the wider Bitcoin community pleaded for miners to leave GHash.io to prevent the possibility of a 51% attack. The imminency of a potential 51% disaster was eye-opening for the community, and resulted in retaliatory measures from malicious individuals of the community. One user committed a DDoS attack (CEX.io, 2015) on the GHash.io mining pool, with speculation in the community it was in response to GHash' potential to commit a 51% attack (Bitcoin Stack Exchange, 2016). A 51% attack is arguably the largest concern among blockchain critics, although as the blockchain develops from

infancy into a more juvenile stage, developments into preventing this kind of attack is becoming more and more intelligent. For example, Komodo's blockchain security service creates blockchain backups, of all who use their service, and updates those back-ups every 10 minutes (Komodo, 2019).

2.2 Blockchain: Potential Benefits

The blockchain is an entirely unique concept not seen in significant practice before. A young innovation of computer science, the blockchain is entirely decentralised, making it immutable, transparent, and free from the potential manipulation of a central authority (Politou et al., 2019). This section will look at the potential benefits of blockchain technology.

2.2.1 Blockchain voting

One benefit of blockchain technology is blockchain voting. The decentralisation of voting is a championed concept among blockchain enthusiasts. In traditional elections, there is a central authority that records, counts, and verifies all the votes. Blockchain technology has the potential to eliminate rigged elections entirely in countries where corruption takes place. In particular, African countries suffer extensively due to corruption through rigged elections, inevitably resulting in unfair representation (Transparency International, 2021). The integration of blockchain technology for conducting elections can eradicate corruption and introduce fair, democratic results. Decentralisation means everyone can hold a copy of the full voting record on their own devices, rather than voting records being fully under moderation from a central authority. The encrypted cryptographic nature of the blockchain ensures all votes are secure and unmanipulable. Duplicate or illegitimate votes cannot be cast, and because it is a shared/distributed database, every participant can hold a complete historical copy of the voting records to track votes to ensure they comply with the rules and can detect suspicious voting patterns. The integration of a more digitalised way of voting can make voting more swift, therefore important decisions can be made quicker and the process of elections can be made a lot cheaper. Smart contracts (programs/code that runs when pre-determined conditions are met) can be designed to create a freer system of voting. People could change their vote should they change their mind, enticing freedom of thought in which people are allowed to update their votes or set permissions for others to vote on their behalf (European Parliamentary Research Service, 2017). The primary drawback of blockchain voting is the minimal knowledge surrounding the topic. Part of a result is people being able to accept it is fair, however if someone does not understand the system they are using, they are more likely to argue that they don't think it's fair, therefore generating disparity on the topic of blockchain technology (Acemyan, Kortum and Oswald, 2022).

Alternatively, businesses can use blockchain voting to conduct votes among shareholders. Votes on investment decisions, company management, or general important matters can be conducted. Using smart contract capabilities, these results can be automatically encoded into a contract on behalf of the company (European Parliamentary Research Service, 2017). The potential growth of businesses and corporations is exponential should they begin integrating blockchain capabilities into their operations. The potential growth is conveyed through estimates that by 2030 blockchain technology could generate $3.1 trillion in new business value (Gartner Inc, 2019).

2.2.2 Supply chain management

Companies and organisations are already offering blockchain services. For example, IBM possesses their own blockchain and offers their blockchain capabilities to other businesses (IBM, 2019). One way in which IBM's blockchain enhances business efficiency is through supply chain management. Blockchain technology is transparent, meaning everyone can see data and information being distributed (if it is a public blockchain). Using a blockchain to manage supply chains ensures transparency and makes logistics much simpler. For example, product information regarding exactly where it is on the supply chain can be uploaded to the blockchain to let a business or individual know exactly where it is and estimate how long it will take to arrive. The purpose of a blockchain managed supply chain varies depending on the industry, more specifically the food industry because of the dependency on perishable products. If a restaurant boasts fresh produce, a blockchain managed supply chain can be used to track the origin of the food from where it is made, processed, delivered, then sold. This can help food businesses prove to their customers that their food is fresh, thus improving reputation and reassuring customers. Restaurants that are a danger to public health can easily be identified through analysis of their blockchain managed supply chain. Authorities can view with pinpoint accuracy the age of products the business sells, enabling authorities to verify quickly whether a restaurant complies with food safety procedures, saving time, thus saving money, and relieving the need for an extensive amount of paperwork (Prashar, 2020).

2.3 Cryptocurrencies: Financial evolution

Cryptocurrencies are a primary topic when studying blockchain technology. It is impossible to not analyse the application of these innovations on the blockchain. This section will look at the possibilities of cryptocurrencies for the current financial infrastructure and how they may change the economic status quo, whilst assessing the obstacles they face to be further integrated within society.

2.3.1 Store of value

Bitcoin is the leading cryptocurrency, accounting for around 60% of cryptocurrency market share (Perić, 2022). An attribute that makes Bitcoin so valuable is its ability to be a reliable and robust store of value. It is often described as being 'digital gold', the comparison to gold is no exaggeration (Rudolf, Ajour El Zein and Lansdowne, 2021). To analyse why Bitcoin is so valuable, one must first evaluate the desirability of the traditional commodity, gold. Ever since the days of ancient Egypt, gold has arguably been the safest store of value. What makes it so valuable is determined by 6 characteristics: scarcity, durability, divisibility, transportability, recognisability, and fungibility (Federal Reserve Bank of St. Louis, 2019). Bitcoin is superior in every characteristic. Bitcoin has a maximum of 21 million coins making it far more scarce than actual gold, thus making it more valuable (Ciaian, Rajcaniova and Kancs, 2015). The security principles of blockchain technology, and the ability to make further security developments, make Bitcoin the most secure and durable store of value since the beginning of gold as a universal ledger. Bitcoin is far more divisible, it can be divided down to 8 decimal places, alternative to the GBP or USD which is only divisible to 3 decimal places (P. Hanley, 2013). Bitcoin is made up of 'Satoshi's'. A Satoshi is one unit of a Bitcoin (0.0000001 of a bitcoin). Being able to subdivide a bitcoin down to Satoshi's eliminates the possibility of inflation, which can fluctuate values within an economy, inevitably causing elevated costs of living. The divisibility demonstrates the superior utility of Bitcoin compared to gold. Furthermore, given cryptocurrencies are a digital asset in an increasingly more digitalised world, they can be transported through almost any smart device where there is connection to the blockchain. Bitcoin is no stranger to fame, having made headlines across the world for numerous years now, it has become almost on par with the familiarity levels of the U.S. dollar (Benzinga, 2021). The value of Bitcoin is cemented on its blockchain, all bitcoins will always universally be worth the same as what is stated on the blockchain, proving the fungibility of the token.

However, it is also argued that the decentralised nature of these characteristics cause instability. When the supply is controlled by unpredictable events in the cryptocurrency market, it can lead to economic turmoil and have destabilising effects on the financial system (Kiviat, 2015), a primary counter-argument for cryptocurrency recognition.

2.3.2 Concern among centralised economic and political institutions

Cryptocurrencies offer a secure and decentralised method of value, a concern among governments and banks. For millennia economic controls have been in the hands of a central authority for the reason of monetary management and stability. Now that the blockchain makes these reasons for a central authority void, governments concerned with maintaining economic control grow increasingly

uneasy (The Economist, 2021). It is no surprise countries with authoritarian, more centralised governments are wearier, as it offers a means for the population to gain control. China is an example, banning mining in the country entirely in 2021, causing cryptocurrency markets to go bearish. Although banning these mining operations was under the pretext of preserving energy and preventing environmental damage, it is argued the Chinese grew concerned about the potential of damaging and devaluing their own currency, through cryptocurrencies facilitating capital flight from its markets (Shin, 2022). The realisation among the population of a currency immune to government manipulation can be observed as a key concern for China's elite. The higher the influx of a country's currency being invested into cryptocurrencies inevitably means a shift in domestic financial interests, from their own centralised, controlled currency, to a decentralised one. Governments often print more money to solve economic incompetence. This causes inflation making a currency lose value, therefore it can be assumed citizens wanting to secure the value of their assets would want to look for a secure source of value that can't be inflated i.e., cryptocurrencies. The devaluation of a country's currency is arguably the primary concern among nations looking to incorporate cryptocurrencies into their economic systems.

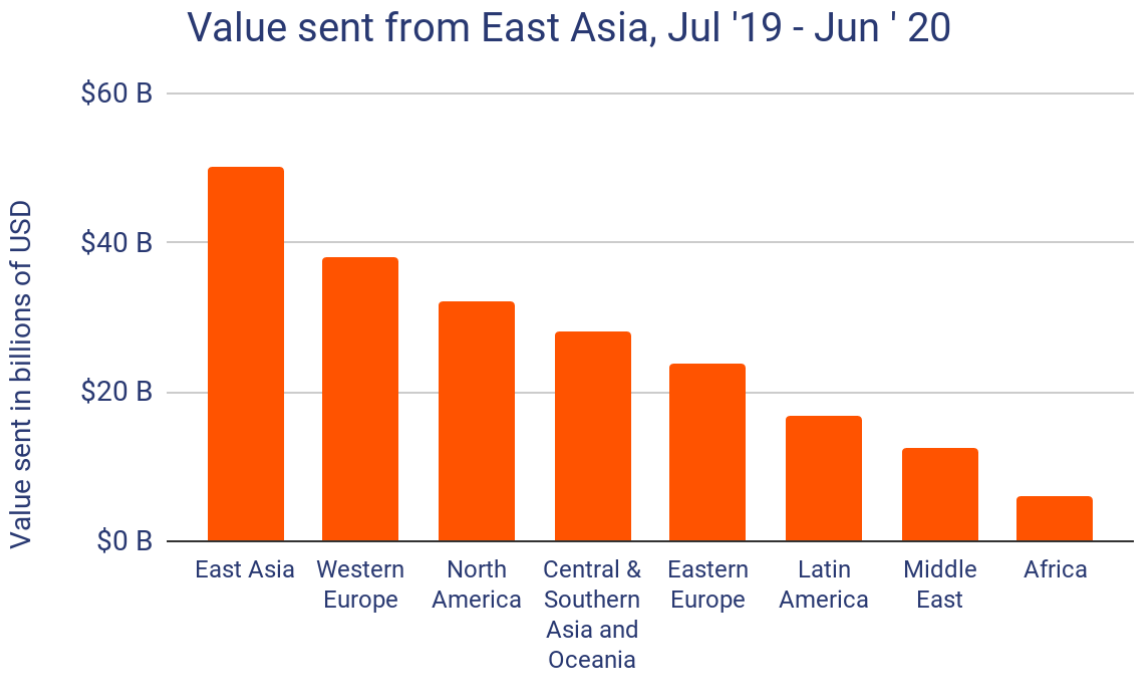


Figure 7 - Estimation of capital leaving to foreign countries through cryptocurrency transactions (Chainalysis, 2020).

Another major concern is from banks. With the blockchain's built in consensus mechanisms and rigorous verification processes, the need for a third party (banks) to verify and execute transactions

becomes void. Banks face a complete overhaul of authority and overall are made not necessary for upholding transactions (McMillan, 2015). Banks offer out loans through the traditional 'I owe you' style of banking, where they conjure money from their reserves. With a fixed amount of cryptocurrency, bank reserves will inevitably deplete. Furthermore, in a more digitalised world assets are slowly becoming more untouchable. Traditionally, banks would loan money that would be used to buy physical products, like equipment for a farm, therefore if the loan wasn't repaid, the bank could always claim the assets bought with the loan (The Economist, 2021b). More and more digital assets are being introduced each year, with it getting harder to keep track of ownership, due to the lack of recognition of ownership legislation put in place for cryptocurrencies.

2.4 Summary

The objective of this literature review was to analyse and interpret research, to assess its validity and relevance to the subject matter of the paper, blockchain technology. This review has broken down the security principles of blockchain technology, its potential integrations, and the analysis of cryptocurrencies. Through extensive research, it is concluded that blockchain technology possesses a great amount for advantages and can open a new chapter for digital innovation. It is evident that the energy usage is one of the biggest threats facing the reputation of blockchain technology, and more energy efficient methods of transaction should be considered. The desire for control among governments and banks also offers some considerable obstacles for cryptocurrencies to overcome, however given they are not at all controlled by these organisations, it can be assumed that they are not going anywhere anytime soon.

3 Methodology

This methodology analyses public attitude towards blockchain technology and cryptocurrencies. The research will consider an individual's knowledge of the technologies in order to determine their attitude towards them, for example, whether people who have minimal knowledge surrounding them have a generally more optimistic or pessimistic opinion regarding their existence. The research conducted will use both quantitative and qualitative methods to provide a broader scope into the attitude towards them, as significant development of these technologies is reliant on them being integrated and adopted by society.

The core aims of the primary research will be to distinguish the general consensus of the blockchain and cryptocurrencies, to measure the average knowledge on the topic, and to enhance awareness and interest in these technologies, by proposing scenarios to encourage critical thinking into the topic.

3.1 Research Design

The methods of research will vary from the use of a survey to analysis of secondary research and existing case studies. Due to the unpredictable volatility of cryptocurrency markets, it is considered that an event of significant magnitude regarding these technologies is not an impossibility, therefore an agile approach, in which research can be reviewed and amended to uphold the validity of the paper, is undertaken.

The use of a survey enables for both qualitative and quantitative questioning which can help broaden the analysis of the results. The use of an agile framework enables the research to consider that events in the real world may change resulting in new questions being added to the survey. The survey will act as an experiment to assess the attitudes towards cryptocurrencies and blockchain technology.

Case studies will be used to help convey the significance of blockchain technology. The use of a case study containing relevant data and information follows an empirical method of research. This empirical research is chosen to gather results to be used as a foundation for generating conceptual research. The results will help develop conceptual ideas on the opportunities blockchain technology and cryptocurrencies have on the global economic and political infrastructure.

3.2 Qualitative Research

The survey has a number of qualitative questions. The intention is to enable critical thinking through the integration of open questions. This will help with fulfilling an objective of the paper: assessing the attitude towards blockchain technology and cryptocurrencies. This approach enables thematic analysis of responses, discovering trends in public opinion. Thematic analysis enables research results to be condensed into simpler, easier to read themes/trends rather than reviewing each answer individually.

Case studies are reviewed to justify their relevance and validity. These case studies propose scenarios that can be compared to the principles of blockchain technology, in order to determine whether blockchain technology offers solutions to the problems proposed.

3.3 Quantitative Research

The primary research was conducted through the use of a public survey. The survey asked a mix of open and closed questions which in turn generated qualitative and quantitative data. The quantitative approach is used to uncover the consensus among the general population about whether these technologies are viewed positively or negatively, and to determine levels of knowledge surrounding them.

The online survey listed 12 questions. These questions begin with asking for consent for their data to be used in order to comply with ethical rules. Some closed questions were given the alternative 'other' option, should the participant choose to expand on their answer. The survey questions are as follows:

1. Do you consent to your answers being used for research towards cryptocurrencies?
2. What is your age?
3. To what extent is your knowledge of cryptocurrencies?
4. Do you have a more sceptical or more optimistic view on cryptocurrencies?
5. Are you aware of any positives or negatives of cryptocurrencies in general?
6. What are your primary concerns about cryptocurrency, if any?
7. Are you aware of the impact cryptocurrencies have on the environment?
8. Would you be in favour of a digital voting system in which ballots cannot be forged or duplicated?
9. Would you be in favour of being able to track exactly when and where tax money is being spent by your government?

Please read the following statement and then answer the question below:

> *"Imagine that each banknote in circulation was accompanied by a record of every individual and organization that had handled it and that up-to-date copies of those records were also held in libraries and by individuals across the world. Imagine that each time a purchase was made using cash, these records were checked to reconcile each note with the individual recorded as last owning it."*

10. Do you think wholly transparent transactions, in which funds can be traced back to their creation, are a good idea? Please explain your answer.
11. Do you think a method of finance that cannot be controlled or manipulated by governments is a benefit or limitation to society?
12. Do you think a more digitalised economy, through the introduction of cryptocurrencies as legal tender, is a good idea?

The results of the quantitative data allow the use of descriptive statistics for the data analysis, making trends and themes easier to understand. The survey had the objective of collecting data from a variety of different age groups. The purpose of this is to investigate how the factor of age may influence a person's opinion on these technologies. The survey was open for 4 weeks.

3.4 Ethics

The research conducted followed ethical procedures to promise privacy and confidentiality of participants and was reviewed and approved by the university. All research complies with appropriate regulations put in place, and primary research asks the participants' approval for their data to be used for research.

4 Research Findings

This chapter will present the results of the survey distributed among the public. The survey gathered data from 35 participants from a variety of different ages. The purpose of the survey was to assess the levels of awareness regarding the factors and attributes of blockchain technology and cryptocurrencies, in order to discover the obstacles facing these technologies when considering their integration into society. The use of survey results aid in answering the research question: What are the impacts and opportunities of blockchain technology and cryptocurrencies on the global economic and political infrastructure? The survey consisted of 12 questions.

The survey content/questions can be accessed via the appendices chapter.

4.1 Survey

Question 1 asked for consent regarding their answers being used for the research. This question is crucial for complying with ethical rules and standards, ensuring it does not violate the academic institution's ethical and privacy policies. 97.2% of participants gave their consent and their responses will be analysed, whereas the latter will not have their data evaluated in this paper.

Question 2 asked the participants for their age. Under a tenth of participants (8.8%) were part of the younger bracket, 16-18. Just over half of participants (52.9%) are 18-24. Only 1 participant, accounting for 2.9%, was between 25-35. Conclusively, 35.3% of participants were over the age of 35. A sub-objective is to assess how age may also affect the difference in opinion of the technologies.

4.1.1 Cryptocurrency questions

Question 3 asked participants their extent of knowledge surrounding cryptocurrencies. This question uses a 'Likert scale' to offer a range of options in order to break down participants responses to a more significant extent. The options offered are as follows: Significant knowledge, knowledgeable, neutral, little knowledge, very limited knowledge. The results are diverse, with 5.9% admitting significant knowledge, 38.2% claiming they are knowledgeable, 8.8% having a neutral amount of knowledge, 14.7% having little knowledge, and 32.4% declaring very limited knowledge. The quantitative data demonstrates an equal mass on both sides of the knowledge spectrum, with an overall calculation of 44.1% on the upper end of knowledge, and 47.1% accounting for the lower end of knowledge. This gives the results a fairly even split, and thus creates a diverse range of opinion to be evaluated in the discussion chapter.

Question 4 aimed to evaluate the attitude towards cryptocurrencies. Participants were asked whether they have a more optimistic or more sceptical view towards cryptocurrencies. Participants were offered three options: optimistic, sceptical, or other. 41.2% declared a more optimistic opinion, 50% declared a more sceptical opinion, 8.7% broadened their answers with the 'other' option. These answers consisted of one declaring too little knowledge to give an opinion, another stating they believe cryptocurrencies will 'succeed', and another expressing an equal opinion of both scepticism and optimism.

Question 5 was tasked with assessing the awareness for the impacts of cryptocurrencies. Participants were asked whether they were aware of any positives or negatives of cryptocurrencies in general. 67.7% declared they knew of at least one positive or negative, the latter 32.3% declared they were unaware of any.

Question 6 had the purpose of narrowing down specific scepticisms surrounding cryptocurrencies. 82.4% listed at least one valid concern, contrasting data from question 5 suggesting 32.3% declaring they were unaware of any. The remaining 17.6% listed no concerns or an invalid answer.

Question 7 asked whether participants are aware of the impact cryptocurrencies have on the environment. 64.7% stated yes, they are aware, whereas the latter 35.3% declared they were not aware.

4.1.2 Blockchain scenario questions

Question 8 begins to ask questions regarding the implementation of blockchain security into societal systems using a scenario. Participants were asked whether they would be in favour of a digital voting system in which ballots cannot be forged or duplicated. This is in reference to one of the security principles of blockchain technology. The question had closed answers of 'yes' and 'no', with an open option of 'other'. A majority 79.4% voted 'yes' in favour, 11.8% voted 'no', with the remaining 8.8% declaring their opinion through 'other'. There was a total of three open answers. One answer argued that even digital voting can be manipulated, another declared they would need to know more, and the final supports the traditional use of physical ballot boxes.

Question 9 continues on the subject of blockchain technology, using another scenario, this time relating to blockchain transparency. The question asked the participant whether they would be in favour of being able to track exactly when and where tax money is being spent by their government. The majority 85.3% voted 'yes', 8.8% voted 'no', and the remaining 5.8% opted 'other'.

Question 10 quotes a scenario from an academic paper titled 'Cryptocurrencies and the blockchain' (Tredinnick, 2019). The scenario is presented below:

> *"Imagine that each banknote in circulation was accompanied by a record of every individual and organization that had handled it and that up-to-date copies of those records were also held in libraries and by individuals across the world. Imagine that each time a purchase was made using cash, these records were checked to reconcile each note with the individual recorded as last owning it."*

The participant was asked to read the scenario and answer whether they think wholly transparent transactions, in which funds can be traced back to their creation, is a good idea. This question was open for the purpose of assessing the attitude towards a primary attribute of blockchain technology, everyone being a witness therefore transactions are made transparent (Stornetta, 2021). 47% are in favour of the concept of financial transparency, 23.5% argue that it would be a bad idea, often thematically stating concerns regarding privacy. 29.5% had a more balanced opinion, outlining arguments for and against.

Question 11 asked participants whether they thought a method of finance that cannot be controlled or manipulated by governments is a benefit or a limitation to society. The overall consensus was 64.7% saw it as a benefit, 17.6% see it as a limitation, 8.8% see it as both, and the final 8.8% were unsure, overall leaning in favour of general positivity.

The final question, question 12, has one of the broadest range of opinions. The participant is asked whether they think a more digitalised economy, through the introduction of cryptocurrencies as legal tender, is a good idea. 47.1% declared 'yes', 14.7% declared 'no', and the remaining 37.7% define their opinion through the option of 'other'. Over half of those who answered 'other' declared they are unsure or that they would require more general knowledge surrounding cryptocurrencies to confidently answer. The remainder took the opportunity to give a definitive answer, although only if certain conditions were met. For example: "Yes, but only if it is used in the same way as our current system. Purely transactions, not traceable".

4.2 Case Studies

This section of the chapter illustrates the findings from relevant case studies that set examples of the flaws of the current financial system, in which the principles of blockchain technology could improve it, thus preventing corrupt financial and political activity. Case studies are chosen in context to the aims of the paper.

4.2.1 Pandora Papers (Panama Papers)

In 2015, the world witnessed the biggest data leak of all time. An anonymous whistle-blower from Panama-based law firm *Mossack Fonseca* leaked 11.5 million documents revealing tax evasion and

other illicit uses of offshore bank accounts by individuals of high profile. The documents detailed 40 years' worth of confidential documents belonging to over 200,000 'shell companies' that were used to hide money from tax authorities (The International Consortium of Investigative Journalists (ICIJ), 2021). These companies were based in 21 different tax havens, from Hong Kong to Nevada, with the majority based within the British Virgin Islands. Individuals, from presidents to famous athletes, disguised their wealth from tax authorities through hiding their fortunes with close individuals. The individuals among the findings were sportsmen, such as Tiger Woods and Lionel Messi, relatives to politicians, such as David Cameron's father, and heads of state, such as Russian president Vladimir Putin (Harding, 2016).

4.2.2 UK Government: plan for Cryptoasset technology hub

The UK Treasury released a report outlining a concrete plan to make Britain a leader in cryptoasset technology and investment. This huge shift in domestic economic policy demonstrates a shift in attitude by governments towards cryptocurrencies. They announced a plan to recognise 'stablecoins' as a valid form of payment in an attempt to attract cryptocurrency investors to UK shores. The plans include intention for new legislation for a 'financial market infrastructure sandbox' to help firms innovate on cryptocurrencies, an FCA-led 'CryptoSprint' focused on informing regulatory policy changes, creating a government backed NFT, and establishing an 'engagement group' to analyse and become more aligned with the crypto industry. The report also outlines the intentions to investigate the potential of 'Distributed Ledger Technologies' within UK markets. (HM Treasury, 2022).

4.2.3 Tesla's U-turn

In February 2021, electric car company Tesla, headed by Elon Musk, purchased $1.5 billion of Bitcoin and announced they would begin accepting Bitcoin payments for purchases of their products. Bitcoin reached an all-time high of $65,000 within a month of the announcement. A few months later in May, Musk declared Tesla would no longer accept Bitcoin, primarily due its damage to the environment. The reversal of Tesla's acceptance sent the cryptocurrency tumbling down to $30,000. Musk stated that the company would restart taking Bitcoin payments once it conducts due diligence on the amount of renewable energy used to mine the currency. Only when the use of renewable energy to mine Bitcoin reaches at or above 50% would Tesla resume accepting Bitcoin (Reuters, 2021).

4.2.4 The Elon effect

Elon Musk has enormous influence over the prices of cryptocurrencies. It was Musk's decision for Tesla to adopt Bitcoin, which led the crypto to rise 20% in one day. Another example is his endorsement of Dogecoin, another, although far smaller, cryptocurrency. On February 4th, 2021, Musk posted on popular social media platform twitter the caption "Dogecoin is the people's crypto" causing the price of the coin to skyrocket 50% in a single day. Towards the end of that year on December 14th, Musk announced a 'trial run' accepting dogecoin as payment for Tesla merchandise, causing the cryptocurrency to rocket 43% in value in 2 hours, thus demonstrating the cryptocurrency markets volatility (Oosterbaan, 2021). The influence of Musk was investigated by US regulators over the impact of his tweets on share prices and other markets (The Independent, 2021).

4.2.5 China bans cryptocurrencies

In September 2021, China enforced a ban on all cryptocurrency transactions. China cited the reasons as facilitating illicit financial activity and threatening China's financial system. The worry stemmed from statistics that showed masses amount of capital leaving the country's financial infrastructure thus leaving the Chinese economy (Shin, 2022). China had previously banned the practice of cryptocurrency mining (not transactions) two years prior in September 2019, which struck the heart of the industry, as China accounted for around 76% of all Bitcoin mining activity (Statista, 2022). Having seen Bitcoin exceed the value it was before the mining ban; the Chinese declared all transactions of the assets illegal.

4.2.6 Save the Kids scandal

'YouTubers' (influential video creators) with a substantial following, primarily consisting of young people, endorsed a cryptocurrency named 'Save the Kids'. The incentive for investing in this token was earnings from it were to be gifted to children's charities. This token was in fact a Ponzi scheme, in which influencers promoted the token to their followers so that they would invest, therefore making the value of the token go up. The YouTubers held the vast majority of the tokens, used their fans' investments into the token to pump up the value, then the YouTubers sold all their tokens at the same time as each other, sending the price crashing. The result of this was they made a massive profit whereas their fans who thought they were investing in a good cause, lost the majority of their investments (Business Insider India, 2021).

5 Discussion

This chapter aims to elaborate and evaluate the research findings. The results will be interpreted to discuss what implications they may have on the aims and objectives of this paper. Using the survey results and the analysis of case studies, correlations will be examined to interpret the general consensus on whether blockchain technology and cryptocurrencies are a positive or negative innovation to society, to provide suggestions on improvements to be made to these innovations to justify and enable their integration into economic and political infrastructures. The attitudes conveyed in the survey are to be compared to facts made in the literature review and other relevant research material in order to uphold arguments made in this discussion. The overall objective of this discussion is to rectify negative arguments made against the technologies in the research findings using relevant and credited literature obtained in this paper.

5.1 Common disadvantages

The results of the survey presented a number of common similarities of opinion. For certain questions, a high volume of participants that gave similar answers. These answers enable the paper to pinpoint what issues regarding blockchain technology and cryptocurrencies are the obstacles facing them in obtaining economic and political favour within society.

5.1.1 Volatility, incentives, and fraud

Many participants declared volatility and stability to be their primary concern. This concern is justified given the implications certain individuals have on the price of certain cryptocurrencies. An example of volatile price fluctuation is Elon Musk, the case study regarding Tesla demonstrates the influential power Musk possesses (Oosterbaan, 2021). The magnitude of volatility the opinion of a single individual can cause is a major prevention factor for cryptocurrency acceptance, as demonstrated through an acknowledgement of Musk's behaviour from a participant of the survey. This participant stated that 'unreliability' (which coincides with volatility) was their primary concern, citing Musk crashing Bitcoin when he declared Tesla would no longer accept payments of the cryptocurrency (Reuters, 2021). The participant also answered that they have a very limited knowledge of cryptocurrencies. The acknowledgement of volatility regarding cryptocurrencies although they have 'very limited knowledge' creates reassurance that even those with minimal knowledge are aware of the risks involved. One participant stated people would "lose money" because they would "not understand the system". The combination of volatility and a lack of understanding would categorically result in losses, which is why an aim of this paper is to raise awareness of cryptocurrencies and blockchain technology. The consistency of concern regarding

volatility marks it as a key factor driving pessimism towards cryptocurrencies and reinforces the need for heightened awareness regarding them.

The volatility argument is often to blame for the incentive for new investors with little knowledge on trade, causing them to inevitably lose their money on flawed trade decisions. Cryptocurrencies are commonly perceived by those sceptical on the technology as a method of easy money. The truth of this is conveyed through a response to the survey question: 'are you aware of any positives or negatives of cryptocurrencies?' In which the respondent answered, 'they make people rich?' This is a dangerous impression of the cryptocurrency market and the need of eradicating this perception is paramount to building a positive reputation on the technology. New investors drawn to cryptocurrencies by the fake promise of quick, easy money are often victims of Ponzi schemes (Security Exchange Commission, n.d.). The 'save the kids' token case study highlights the dark manipulable nature of cryptocurrencies, and also ties into the Elon Musk debate regarding the power of influence which can cause significant financial losses. A way in which losses can be prevented is through raising awareness of blockchain technology and cryptocurrencies and how they work.

Cryptocurrencies are often promoted through social media like YouTube (save the kids token) and also Instagram. This is a concern acknowledged from survey question 6: "people losing their money as they're unable to do it but see it promoted on Instagram as accessible". This statement subtly conveys the need for trading organisations to do more to restrict trade to those that have a very limited knowledge, as it is often perceived as a method of volatile gambling (NBC News, 2022). Trading platforms often present a questionnaire to assess the level of trading knowledge in order to verify the individual to use the platform. A method in preventing those with limited knowledge is through improving the assessment mechanisms these platforms offer, potentially through asking more complicated trade questions, in order to restrict those that have limited knowledge. Often the reason traders are 'unable to do it' is because they lack the fundamental knowledge of how prices on markets fluctuate, for example through buying and selling volumes.

5.1.2 Environmental Issues

A promising factor of awareness came with the acknowledgement of environmental issues. The majority declare they are aware of the impact cryptocurrencies have on the environment, beneficial to encouraging cleaner energy. There is a persistent trend of concern within the results of the survey regarding the impacts on the environment, making it a key preventative factor for its recognition by governments. A number of participants understand the significance of the 'power wastage' from cryptocurrencies, correlating with the information displayed on the energy usage chart (**see figure 6**)

within the literature review. The flaw of energy wastage is further supported by Elon Musk and his demand for Bitcoin to become more energy efficient. The way in which cryptocurrencies could do this is through switching form proof-of-work to proof-of-stake consensus mechanisms, which use drastically less power (Sedlmeir et al., 2020). Ethereum is setting an example by making this move through the merge of Ethereum into Ethereum 2.0 (Cryptopedia, 2021). Environmental damage is of enormous concern among participants of the survey (20% listing it as their primary concern). High profile figures such as Mr Musk, as well as countries like China that banned the practice of cryptocurrency mining entirely, highlight energy efficiency as a primary disadvantage for the innovation, tarnishing any hope of being an officially recognised means of payment, and damning hopes of further economic integration.

5.2 Common advantages

Whilst there are evidently many issues surrounding blockchain technology and cryptocurrencies, mostly due to the principles of blockchain technology that enable cryptocurrency issues i.e., non-energy efficient consensus mechanisms, there are many positives. Respondents often cite the decentralised nature through the suggestion of blockchains being free from government manipulation, preventing inflation (Schilling and Uhlig, 2019). The immunity to inflation means assets can be classed as a safe store of value, as acknowledged from a participant: “positive, decentralised store of value…” The reference to a store of value demonstrates a positive correlation to the argument comparing Bitcoin to gold within the literature review. Moreover, the decentralised nature can mean it can be harder to trace funds, however with a specially constructed blockchain, transactions of funds can be made more transparent than ever (Demestichas et al., 2020). The transparent nature of a blockchain could have ensured prevention of illicit dealings within the pandora papers, upholding a fair financial system. This is done through the ability to trace transactions down to their creation, to determine exactly where funds go (Tredinnick, 2019). This idea of wholly transparent transactions is mostly interpreted positively among participants of the survey. Many of these positive responses are justified through the interpretation that it will prevent fraud and illicit activity, whereas the primary counter argument among participants is that it can violate privacy. Blockchains can be tailor made to suit certain conditions so that privacy is not violated. The pandora papers case study shed light on the pandoras box of financial corruption prominent within our society, a box that can potentially be closed through the careful construction of transparent blockchain managed financial systems.

Blockchain voting is a heavily supported idea, results from the survey reveal. The vast majority are particularly favourable towards a method of voting that cannot be manipulated, demonstrating a

real possibility of blockchain integration within political systems. A latter argument supporting the traditional use of ballot boxes gives purpose and reasoning to an objective of the paper, raising awareness and understanding of blockchain technology. The participant questioned: “what if the computer system crashes?” The blockchain is held up by thousands of independent nodes around the world, therefore, if one computer crashes the rest continue to operate. Another argument further conveys the need for education on blockchain technology principles, stating that “even digital voting can be manipulated”. The decentralised nature of the blockchain immunises its ability to be dictated by a central authority, nullifying this argument. Although in theory this is true, however if a blockchain voting system was made private, in which only citizens of the country in question can access the blockchain to vote, then the authorities could ensure no number of nodes within the country have more than 51% of the computational power, upholding the blockchain (LIEBKIND, 2020). This would make it fair and trustworthy, essential attributes for an election.

5.3 Conclusion of discussion

This study touched the surface of blockchain possibilities. Certain time constraints and limited resources impeded the potential of deeper analysis, therefore suggestions for future improvements are constructed as follows: integrating more Likert scales of extent, for example asking to what extent people know of the impact cryptocurrencies have on the environment, to interpret the understanding of participants better. Conducting interviews with industry professionals to grant a more professional and broader view of blockchain possibilities. Further research into methods of energy efficiency through extensive analysis of consensus mechanisms and how regulation can improve miner energy efficiency.

Overall, the findings from the respondents reflect a correlation of inadequate amounts of knowledge and disfigured/misinformed views on the attributes regarding blockchain technology. Although there were a number of respondents that declared to have an above average knowledge on the subject, through analysis of the individual responses of those claimants, it can be concluded that their knowledge may be self-misjudged. With respect to these respondents, interpretations and claims made such as ‘even digital voting can be manipulated’ can cast doubt on the actual extent of knowledge of the public regarding these technologies, reinforcing the need for the existence of this paper, and the need for the aims of the paper be further pursued.

6 Conclusion

This paper intended to investigate the potential benefits and limitations of integrating blockchain technology into economic and political infrastructures. It was also considered whether the extent of public knowledge and awareness on this technology hinders its progression into these economic and political systems. These benefits stem from supply chain management, deflationary stores of value, blockchain voting, and a financial system free from all central authority, instead dictated by three principles of blockchain technology. Businesses, financial systems, political systems; all pillars for upholding a modern society are set to be brought into a new age of modernisation through decentralisation, cryptography and consensus mechanisms. Blockchain technology offers a new secure way of data transfer, which can be applied to any computer system in the world. An innovation with the ability to change the way in which society functions almost entirely, through rigorous security and efficiency, is something that only arrives once in a generation.

The next steps are crucial to bringing forward the inevitability of cryptocurrency acceptance and modernised blockchain database structures. For the future, blockchain developers must explore ways to assure privacy through custom blockchains, and make blockchain technology more accessible to the public to increase understanding among the general population. The key goal cryptocurrencies must pursue is renewable means of mining through mass adoption of proof-of-stake mechanisms to prevent damning legislation that would lead to their demise, and thus only delaying the future of the innovative data distribution marvel that is blockchain technology.

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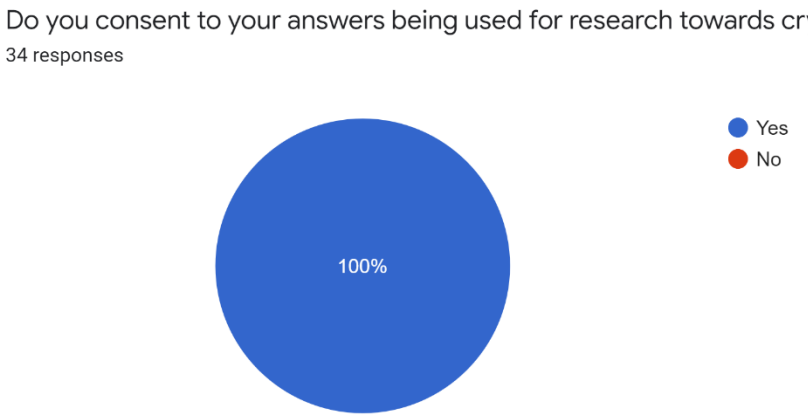
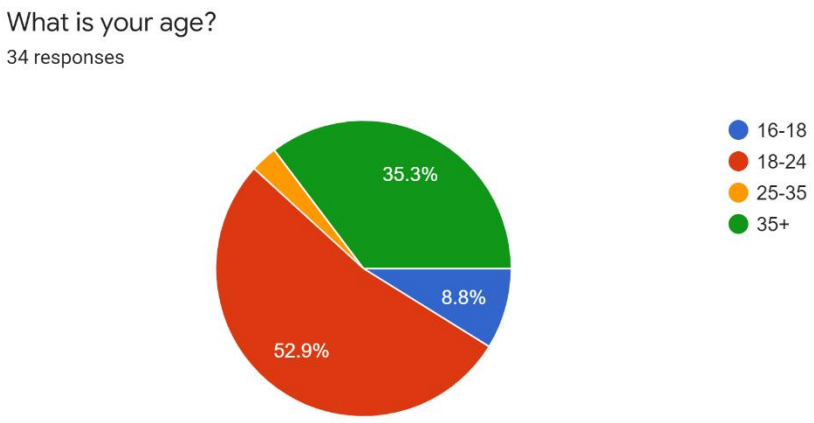
Appendix 1 – Survey Results/Charts

1.1



1.2



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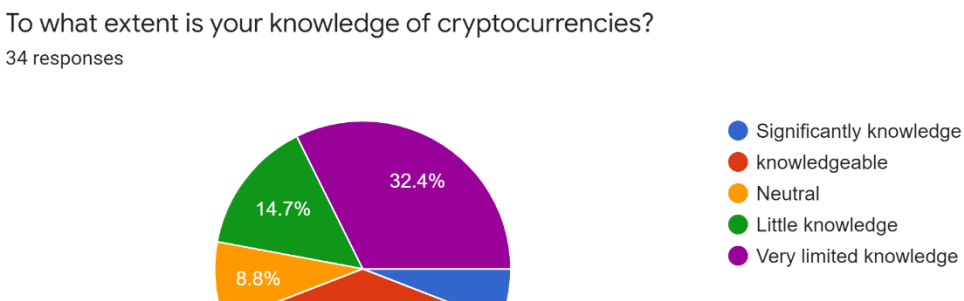
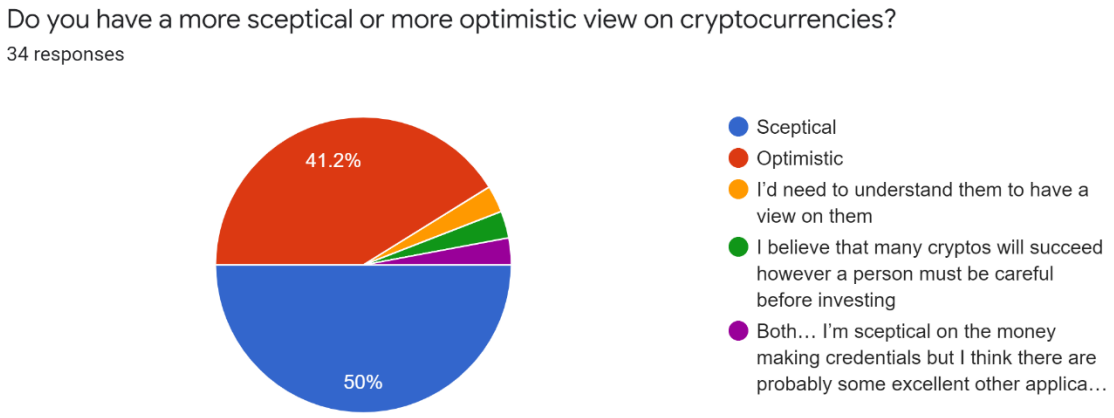


1.4



"Both… I'm sceptical on the money making credentials but I think there are probably some excellent applications of blockchains."

1.5

Are you aware of any positives or negatives of cryptocurrencies in general?

34 responses

No

Yes

Negative: it could be classed as similar to gambling

DeFi being countered by the CBDC defeating some of the purpose. Elements seemingly decentralised by name when in reality it is a new way of invading your personal space brought on by luring you into a system people might not understand fully.

Positives, world wide currency devoid of government interference. Negatives fake traders scams. Too unregulated.

Negatives

no

They make people rich?

Volatile prices

Yes, I feel its unstable.

Positive, decentralised store of value. Negative, potential use by fraudsters

Main negative is the enormous amount of power required to mine them - I work in the datacentre industry

Emissions as a result of their production and use

No idea

Positives: very secure and can allow for anonymity of the users. Negatives: can be used in back market deals which can make them almost impossible to trace.

Positives being the currency is untraceable but it also invite a chance of getting scammed

Reduces the government's ability to control / enforce / trace transactions. This can be both a good and bad thing.

I like the decentralized approach that blockchain brought but the volatility of most of these currencies is problematic….I am more upbeat about some of the stablecoin options appearing recently.

It is a safer way to exchange money and make payments, however currencies can be quite volatile at the moment and there is the chance that you lose the money you put in.

Lack of regulation
Swings in gains v loss

1.6

That you would lose money
None
Risky market and consumes a significant amount of energy
Difficult to understand
The above, meaning its value is arbitrary. But this depends on the currency of course.
People losing their money as they’re unable to do it but see it promoted on Instagram as accessible
It's highly volatile.
Safety
Stability of the crypto markets.

What are your primary concerns about cryptocurrency, If any?

34 responses

It is used as a way of getting 'easy money'.
Environmental impact
Don’t have any
Fake sites and criminal activity.
Unreliability e.g. Elon musk causing crash of bitcoin
Associated with money laundering
n/a
N/A
I don't have enough

Scamming and people losing money to a system they might not understand

Environmental impact of all the essentially wasted power

I am horrified by the environmental impact of bitcoin, in its current incarnation.

Things like bitcoin mining, where people have massive farms to identify IDs, this is because it can have drastic effects on global warming

Lack of transparency and potential use in criminal activity.

Losing money

Losing passwords, hacking, and being devalued quickly

High risk of money laundering and terrorism financing. Price change risk - it could lose value and become worthless. System risk. Trading fees. Lack of regulations. Anonymity.

Too many different cryptos, fraud and energy consumption

The anonymous creators of the blue chip coins

Regulation

Pls see above

Volatile

environmental cost.

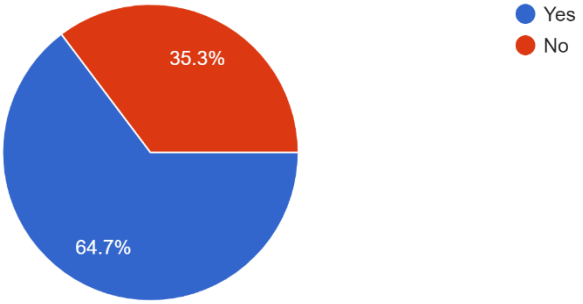
I don't have any.

That it fluctuates regularly and drastically.

1.7

Are you aware of the impact cryptocurrencies have on the environment?

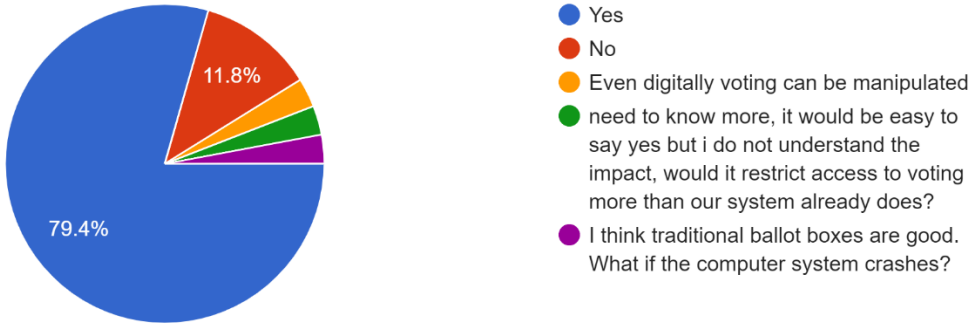
34 responses



1.8

Would you be in favour of a digital voting system in which ballots cannot be forged or duplicated?

34 responses



1.9

Would you be in favour of being able to track exactly when and where tax money is being spent by your government?

34 responses

1.10

Please read the following statement and then answer the question below:

"Imagine that each banknote in circulation was accompanied by a record of every individual and organization that had handled it and that up-to-date copies of those records were also held in libraries and by individuals across the world. Imagine that each time a purchase was made using cash, these records were checked to reconcile each note with the individual recorded as last owning it."

No, I don't think it would matter.

No, it is a way to creep deeper into our lives about what we do and what we buy. The argument however will be this can be used in an effect to decriminalise. To the average person, this can be used to scrape every penny of what may be owed to the government whilst the elite who may own a certain portion of considerable wealth need not be affected because their assets can be hidden and exchanged with the material world such as gold.

Maybe

Possibly, would help prevent money laundering but weighed against the costs of managing such a creation not sure it is viable option.

No, it takes away all privacy - reminiscent of facial recognition controversy, feels almost dystopian

Could be useful in some situations

idk

Maybe- they could help identify fraudulent or illegal transactions taking place

Yes

Yes because it's tracked

Mostly positive as it gives a currency footprint which can mean it's history is back logged

Yes, similar to the service books for a car, it would make it easier to track its origin point. Especially useful to track/crackdown money laundering etc.

No it seems impossible to sustain

No, means people can't go about certain things, E.g if someone likes weed, which is pointlessly illegal then they wouldn't be able to untraceably purchase the substance. This legally is a good idea, but I think it encroaches on freedom. Plus the toll on the environment storing such vast amounts of data would be significant.

Yes however in modern day technology is just as able to be duped as paper and the truth would probably be twisted regarding the distribution of peoples's money

It's probably a bit overkill for currency. It makes sense for other goods where the provenance is important.

Yes as we need to care more for environment and each other

Yes, will help prevent fraud and also allow for the public to see where government spending truly goes.

It's useful when it comes to a clean transaction between strangers but when it comes to people who know one another it seem unnecessary

Maybe? For accountability / anti-corruption purposes for public / taxpayer money. But there are privacy concerns if this applies to private citizens too.

It depends how this is implemented and who has the ability to view the data.

I don't think that transparent transactions should be a thing. The point of cryptocurrency is to keep obscurity and anonymity to protect a user. If it can be tracked back then it may leave a user exposed to identifying personal information.

It depends what you want to achieve from having such a granular method of tracking end to end transactions. I think it would require a lot of data storage that in turn impacts environment. Whilst in principle it is a good idea, it could encourage other behaviours or methods of trading that could increase organised crime as people want to trade 'under the radar'. I am not convinced of the benefits as I think software for compliance and sanction checking is probably already sufficient in identifying any rogue transactions.

Difficult to conceptualise this… creation when?

Yes, I feel it could reduce criminal activity.

Yes although it is very complicated

Good, a complete audit will allow crypto to replace Fiat

In order to track where tax payers money and public spending yes, for individuals no as it removes their privacy

Yes because we have accountability

I'm not sure what purpose that would serve tbh.Obviously half of that happens today, but the anonymous bit is the user.

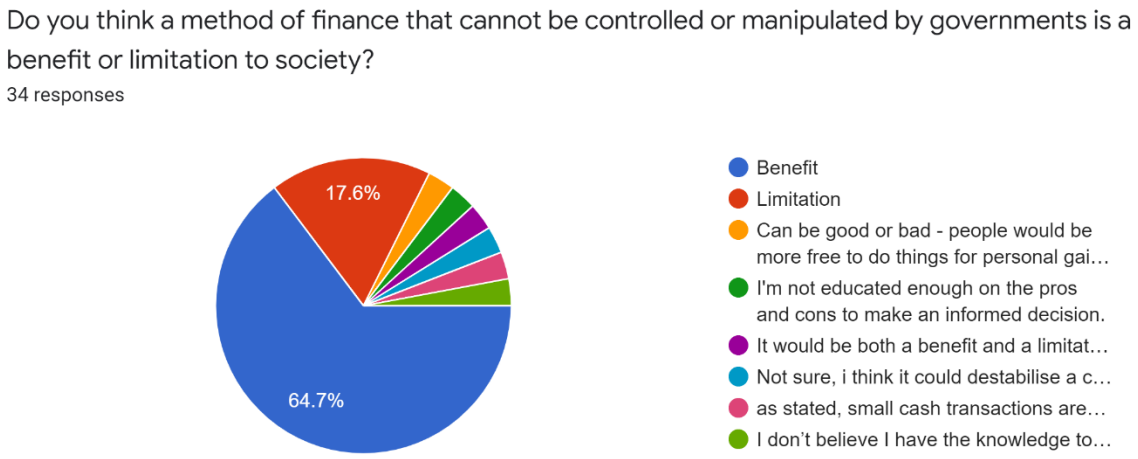
No as it can be used against you by the state or special services

small amounts of cash no, certainly not. We need some privacy and some of the cash (black) economy helps those who are desperately in need. Whereas when large amounts of money are used then yes, we need to stop protecting the obscenely rich stealing from the country and the poor.

No
Maybe this is aimed at older people. I'm only 15 and I'm not sure what cryptocurrencies are I think maybe this is aimed at older people or I need better educating on the topic.

Yes because fraud can be avoided.

1.11



Can be good or bad - people would be more free to do things for personal gain without considering others.

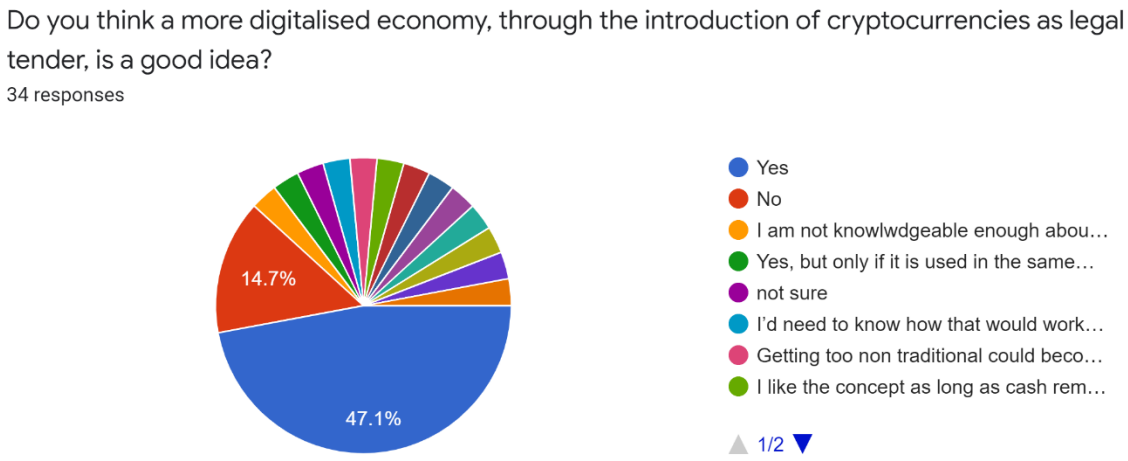
It would be both a benefit and a limitation. Tax would be harder to manage so ensuring that certain industries get funds they need would be tough, such as the NHS. However it would prevent governments putting huge sanctions on those using the currency, for their own gain.

Not sure, i think it could destabilise a country but dont know enough information about it.

as stated, small cash transactions are a benefit. Large amounts of money being hidden harms society.

I don't believe I have the knowledge to answer this question.

1.12



I am not knowledgeable enough about cryptocurrency to make a decision.

Yes, but only if it is used in the same way as our current system. Purely transactions, not traceable.

I'd need to know how that would work to answer that.

Getting too non traditional could become complicated.

I like the concept as long as cash remains a viable option.

I think some aspect of cryptocurrency might be useful in some areas of the economy but when it comes to thing like to stock market or the buying and selling of consumer product I don't think it would be a good idea.

Yes subject to sorting the environmentals. I suspect they will exist side by side for many, many years.

Nice for younger kids to have money and understand the value the of it easier.

I don't believe I have the knowledge to answer this.

Appendix 2 – Ethics Forms

RESEARCH ETHICS FORM 1

WHAT LEVEL OF REVIEW DO I NEED?

GUIDELINES

This form is for staff and students. It will help you identify the level of review needed for your project. Before completing it, you need to:

1. Read *The University Research Ethics Policy*.
2. If you are a student, discuss the ethical aspects of your project with your supervisor.

It is your responsibility to follow the University's Policy on the ethical conduct of research and to follow any relevant academic guidelines or professional codes of practice pertaining to your study when answering these questions.

The questions and checklist in this proforma are intended to guide your reflection on the ethical implications of your research. Explanatory notes and further details can be found in the Policy document.

SECTION 1

DETERMINING WHETHER YOU REQUIRE ETHICS REVIEW

YOUR RESEARCH
Project title**:** **What are the impacts and opportunities of cryptocurrencies on global economic and geopolitical infrastructure?**
Your name**: Marcus Marszalek**

1.	**Is the proposed activity classified as Research or Audit /Service Evaluation or similar?**	
	☒ Research	☐ Audit or Service Evaluation
	*Use the Policy to help you answer this question. If the proposed activity meets the definition of **research** (see the policy), CONTINUE.* *If the activity is an **audit** or a **service evaluation**, STOP. You do not need to seek ethics approval, but you do need to formally register your project with UREC, along with a project outline. To do this complete Form 2.* *If you are unclear what type of activity you are undertaking, please refer to the Policy for additional types.*	
2.	**Does the research involve living human participants, human samples or data derived from individuals who may be identifiable through that data?**	
	☒ Yes	☒ No
	Use the Policy to help you answer this question. *If you answer **NO**, SKIP to QUESTION 6 and CONTINUE.* *If you answer **YES**, CONTINUE.*	
3.	**Is the research being conducted for a medicinal purpose?**	
	☐ Yes	☒ No
	Use the Policy to help you answer this question. See Appendix 2 - FAQs and definitions. *If you answer **YES**, and think your research comes under the definition of 'for a medicinal purpose,' it will need to be scrutinised by the Committee. Please email the Committee Chair (ethics1@winchester.ac.uk) for further guidance on what to do.* *If you answer **NO**, CONTINUE.*	

4.	**Does your research require external ethics approval or review?**	
	☐ Yes	☒ No
	For example, from the NHS or another overseeing body. Use the Policy to help you answer this question. *If you answer **NO**, CONTINUE.* *If you answer **YES**, you need to formally register your project with UREC, along with the relevant external ethics approval. To do this complete Form 2.*	
5.	**Is the project underway and, the researcher or PI, has moved institution to Winchester?**	
	☐ Yes	☒ No
	*If you answer **YES**, please read the following:* *If the research began when the PI was employed at another institution but has subsequently moved to Winchester, and the project has previously been subjected to ethics scrutiny at that institution, then it need not go through ethics review again. The outcome of ethics review by that institution should be communicated to UREC for formal recording. To do this complete Form 2 and include evidence of the previous ethics approval.* *HOWEVER, if there have been significant changes to the original research design which have ethical implications or recruitment of a cohort of participants will be undertaken through Winchester, then the project will require ethics review and you should apply for approval, CONTINUE.* *If you answer **NO**, CONTINUE.*	
6.	**Is the research collaborative?**	
	☐ Yes	☒ No
	*If you answer **YES**:* • *where the Principal Investigator (PI) of the research is located at another institution, it is their responsibility to seek ethics approval, including partner research sites. The outcome of ethics review by that institution should be communicated to UREC for formal recording. To do this complete Form 2 and include evidence of the previous ethics approval.* • *where the PI is located at Winchester, then the project will undergo scrutiny as per Winchester's Ethics Policy, CONTINUE.* *If you answer **NO**, CONTINUE.*	
7.	**Is the research being conducted in another country?**	
	☐ Yes	☒ No

	*If you answer **YES**, please read the following:* *Where a project is conducted in another country, the researcher should consider if it is possible to obtain ethics review by a local research ethics committee or other relevant body. The outcome of such a review by that institution should be communicated to UREC for formal recording, along with a project outline. To do this complete Form 2.* *If this is not possible, the project should be reviewed by the University of Winchester, either at Faculty level or Committee depending on the nature of the proposed work, so CONTINUE.*	
8.	**Does the research involve the use of documentary material, papers, literary works or archive documents <u>in the public domain</u>?**	
	☒ Yes	☐ No
	Use the Policy to help you answer this question. *If you answer **NO** because the works are in a private archive or closed collection, do the following: complete Form 2, including details of the nature of the private /closed collection and provide evidence of the permission to use this material for research purposes.* *If you answer **YES**, you need to formally register your project with UREC, along with a project description. To do this complete Form 2.*	
9.	**Does the research involve the animals?**	
	☐ Yes	☒ No
	*If you answer **NO**, CONTINUE.* *If you answer **YES**, you need to formally register your project with UREC, along with a copy of the relevant licence (if required). To do this complete Form 5.*	
10.	**Does the research involve environmental interventions?**	
	☐ Yes	☒ No
	*If you answer **NO**, CONTINUE.* *If you answer **YES**, you need to formally register your project with UREC, along with a copy of the relevant licence (if appropriate). To do this complete Form 2*	
11.	**Does the data you will collect contain *any* information that could be linked back to participants or that might identify them (e.g. name, address, photo, voice, email)?**	
	☐ Yes	☒ No
	*If you answer **NO**, you need to formally register your project with UREC. To do this complete Form 2.* *If you answer **YES**, CONTINUE.*	

☞ Reaching the end of these questions, **either** you will have been directed to complete a specific additional form **or** you should continue to section 2.

If you are still unsure whether you need ethics review or not, please re-read The Policy and email your query to ethics@winchester.ac.uk with details of your project.

SECTION 2

DETERMINING THE LEVEL OF ETHICS REVIEW REQUIRED

Please mark with an ☒ as appropriate	**YES**	**NO**
Does the research involve individuals who are vulnerable? *For example: vulnerable children, over-researched groups, people with learning difficulties, people with mental health problems, young offenders, people in care facilities, including prisons. For a note on research with children, see Appendix 2 of the Policy.*	☐	☒
Does the research involve individuals in unequal relationships e.g. your own students? *Please note:* 1. *students recruited via SONA are not considered 'your own students.' If you intend to recruit widely across the University or your Faculty (e.g. through snowball sampling or a mail shot) you do not need to consider such students as your own, even if some participants may be students you are directly involved with. Only tick "yes" if you are targeting your own students specifically.* 2. *if you are an undergraduate or postgraduate student carrying out research with children in either a school or early years setting, these DO NOT come under the category of your 'own students*.'	☐	☒
Will it be necessary for participants to take part in the study without their knowledge and consent at the time? *For example: covert observation of people in non-public places, use of deception. See Appendix 2 of the Policy.*	☐	☒
Will the study involve discussion of sensitive or personal topics? *For example: (but not limited to) participants' relationships, emotions, sexual behaviour, experience of violence, mental health, gender, race / ethnicity status or experience, political or religious affiliations. Please refer to the Policy.*	☐	☒

Is there a risk that the highly sensitive nature of the research topic might lead to disclosures from the participant concerning their own involvement in illegal activities or other activities that represent a threat to themselves or others which may need onward reporting? *For example: sexual activity, drug use, illegal activities or professional misconduct.*	☐	☒
Might the research involve the sharing data or confidential information beyond the initial consent given?	☐	☒
Might participant anonymity be compromised at any time during or after the study? *For example: will the research involve respondents using the internet, social media, or other visual /vocal methods where respondents may be identified?*	☒	☒
Is the study likely to induce severe physical harm or psychological distress?	☐	☒
Does your research involve tissue samples covered by the Human Tissue Act (2004)?	☐	☒
Is there a possibility that the safety of the researcher may be in question? *For example: research in high risk locations or with high risk groups.*	☐	☒
Does the research involve creating, downloading, storing or transmitting material that may be considered to be unlawful, indecent, offensive, defamatory, threatening, discriminatory or extremist? *If you answer **YES** to this question, you must also contact the Director of IT Services, who must provide approval for the use of such data.*	☐	☒

Answering **NO** to ***all*** these questions means your project is eligible for Faculty level ethics review. You now need to complete Form 3.

Answering **YES** to ***any*** of these questions means your project will require Committee ethics review. You now need to complete Form 4.

Appendix 2.1

Winchester University: Ethics Form 3

UNIVERSITY OF WINCHESTER

RESEARCH ETHICS FORM 3

FACULTY REVIEW

GUIDELINES

This form is for staff and students. It will help you set out the ethical aspects of your project that need to be reviewed. Before completing it, you need to:

1. Read *The University Research Ethics Policy*.
2. If you are a student, discuss the ethical aspects of your project with your supervisor.

It is your responsibility to follow the University's Policy on the ethical conduct of research and to follow any relevant academic guidelines or professional codes of practice pertaining to your study when answering these questions. This includes providing appropriate information sheets and consent forms and ensuring confidentiality in the storage and use of data.

The questions in this proforma are intended to guide your reflection on the ethical implications of your research. Explanatory notes and further details can be found in the Policy document.

If any aspect of your project changes during the course of the research, you must notify the Chair of UREC.

Winchester University: Ethics Form 3

SECTION 1

YOUR DETAILS			
1.1.	Your name: **MARCUS MARSZALEK**		
1.2.	Your department: DIGITAL TECHNOLOGIES		
1.3.	Your Faculty: BLDT (BUSINESS, LAW, AND DIGITAL TECHNOLOGIES)		
1.4.	Your status:		
		☒ Undergraduate Student	☐ Staff (Professional Services)
		☐ Taught Master	☐ Staff (Academic)
		☐ Research Degree Student	☐ Other (please specify below)
1.5.	Your university email address: M.Marszalek.19@unimail.winchester.ac.uk		
1.6.	Your telephone number: **07940850017**		
	For students only:		
1.7.	Your degree programme: **DIGITAL MEDIA DEVELOPMENT**		
1.8.	Your supervisor's name: **MARINA BRKLJAC**		
1.9.	Your supervisor's department: **DIGITAL TECHNOLOGIES**		
1.10.	Your supervisor's email: **marina.brkljac@winchester.ac.uk**		

Winchester University: Ethics Form 3

SECTION 2

YOUR RESEARCH			
2.1.	Project title: **What are the impacts and opportunities of cryptocurrencies on global economic and geopolitical infrastructure?**		
2.2.	Start date: 21/09/2021		
2.3.	Expected completion date: 4th May 2022		
2.4.	Expected location of data collection: Home, University, Internet (e.g. school, workplace, public place, University premises etc.)		
2.5.	Has funding been sought for this research**?**		
		☐ Yes	☒ No
2.6.	If so, where have you applied for funding? N/A		
2.7.	Has the funding been granted?		
		☐ Yes ☐ No	☐ Pending
2.8.	Is the research collaborative? (e.g. co-investigators from another institution, at or with another organisation or colleagues in another department)		
		☐ Yes	☒ No
		If yes, which?	
2.9.	Is Disclosure and Barring Service clearance required for your study? It is your responsibility to contact the Disclosure and Barring Service (DBS) to confirm whether or not clearance is needed prior to commencing recruitment or data collection. More information here		
		☐ Yes	☒ No
2.10.	Will your research be informed by guidelines from a professional association or specific, agreed standards of practice?		
		☐ Yes	☒ No
		If yes, which?	

SECTION 3

PROJECT DESCRIPTION

Please provide a brief description of your project in non-technical language (between 500-1000 words). This should include details of the research rationale, aim(s), research question(s), context (linking to some relevant literature), and methods (including details of participants, data collection (including examples /descriptions of any audio or visual stimuli to be presented to participants), data analysis) to be used. You should state any ethical issues that you have identified and how these will be dealt with. This overview should contain sufficient information to acquaint the reader with the principal features of the proposal. A copy of the full proposal may be requested if further information is deemed necessary.

Please use this section to list documentation that may be relevant to your application and append it to the submission (e.g. consent forms, information sheets, questionnaires etc.).

A cryptocurrency is a digital or virtual currency that is secured through cryptography (the study and practice of sending secure, encrypted digital assets between two or more parties), which makes it nearly impossible to counterfeit or double-spend. Many cryptocurrencies are decentralised networks based on blockchain technology (a shared unamendable ledger for recording transactions and tracking assets). A key feature of cryptocurrencies is that they are generally not issued by any central authority, rendering them theoretically immune to government interference or manipulation, it is controlled by supply and demand of normal everyday people.

I intend to research the promising recent technical development, cryptocurrencies. My mission is to justify and evaluate the potential for cryptocurrencies in the present and the future, as well as the implications it has on the economic and geopolitical infrastructure of the world. I intend for my research to be concrete facts and claims will be justified through analysing evidence provided by academic papers. I aim to contact professionals in the sector of cryptocurrencies and gather their expected expert opinion to help justify claims made in the paper, thus making the paper well-informed and trustworthy.

The method for the primary research will be through interviews with relevant authors, academics, and industry professionals. The objective of the primary resource is to garner a range of different opinions, and justify cryptocurrencies in relevance to the thesis question. If interviews are not available, a questionnaire is to be distributed to a range of verified and respected individuals with knowledge of this field. The difficulty surrounding questionnaires is the clarity of the question. The questions created are to be concise, as different individuals may interpret the questions differently. Potential bias is taken into account, therefore individuals on both side of the argument for and against cryptocurrencies are included.

For years I have had significant interest in cryptocurrencies and a particular aspect of cryptocurrencies, the blockchain, which I hope to explore in significant detail in the paper. As cryptocurrencies are a relatively new technological development, I believe there is still much more to explore in regard to the possibilities they can offer to society.

Questions conducted within the research will inevitably lead to more questions, currently I have a few questions to begin my research:

- What are the advantages and disadvantages of digital currencies over traditional currency?
- What are the impacts of cryptocurrencies on climate change?
- How can the use of blockchain technology benefit society?
- What are the factors preventing governments from recognising cryptocurrencies?
- How secure is cryptocurrency/the blockchain?

These questions are a few of many to be answered by industry and academic professionals in an industry relevant to the subject matter of the paper. They will answer through a questionnaire, and if possible, I would like to interview them through an online meeting or teams, as I believe it would grant me a better understanding of their answers. These individuals will be presented with consent forms I intend to be reviewed by my supervisor to enable the use of their answers in the paper.

Winchester University: Ethics Form 3

SECTION 4

REFINING THE LEVEL OF ETHICS REVIEW REQUIRED

Please mark with an ☒ as appropriate		YES	NO
1	Does the research involve members of the public in a research capacity as co-researchers? (I.e. as in participant research where involvement extends beyond data collection)	☐	☒
2	Is there a risk of over-disclosure that may put the participants at risk or cause them any anxiety?	☐	☒
3	Will tissue samples (including blood) be obtained from participants?	☐	☒
4	Will the study require the co-operation of a gatekeeper for initial access to participants? (E.g. to students at school, to members of self-help group.)	☐	☒
5	Is the right to withdraw from the study withheld at any time, or not made explicit?	☐	☒
6	Is there any reason participants may feel obliged to participate in the study against their will?	☐	☒
8	Will the research involve administrative or secure data that requires permission from the appropriate authorities before use?	☐	☒
10	Will financial inducements (other than reasonable expenses and compensation for time) be offered to participants?	☐	☒
11	Are there payments to researchers /participants that may have an impact on the objectivity of the research?	☐	☒
12	Is there any cause for uncertainty as to whether the research will fully comply with the requirements of the General Data Protection Regulation (GDPR) (2018)?	☐	☒
13	Does any part of the project breach any codes of practice for ethics in place within the organisation in which the research is taking place?	☐	☒
14	Are drugs, placebos or other substances (e.g. food substances, vitamins) to be administered to the study participants? Please note: for fast track review, it is expected that the study will not involve invasive, intrusive or potentially harmful procedures of any kind.	☐	☒
15	Is pain or more than mild discomfort likely to result from the study?	☐	☒
16	Could the study induce psychological stress or anxiety or cause harm or negative consequences beyond the risks encountered in normal life? (E.g. involve prolonged or repetitive testing.)	☐	☒

If you answer <u>YES</u> to *any* of these questions, please use the next section to indicate which question you have said yes to, describe the ethical issue in the context of your study and how you will address it. If you have answered <u>NO</u> to all questions, complete section 6.

Winchester University: Ethics Form 3

SECTION 6

DECLARATION	
I have read and understood the University of Winchester Research Ethics Policy and confirm that adequate safeguards in relation to the ethical issues raised by this research can and will be put in place. I am aware of and understand University procedures regarding Health and Safety. I understand that the ethical aspects of this project may be monitored by the University Research Ethics Committee. I understand my responsibilities as a researcher as described in the University of Winchester Research Ethics Policy. I declare that the answers above accurately describe the research as presently designed and that a new application will be submitted should the research design change in a way which would alter any responses given in Form 1 or here.	
☒ I confirm that if a Risk Assessment is required I will complete it and have it co-signed by my Supervisor or Head of Department before data collection takes place.	
☒ I confirm that, if DBS clearance is required for my project, then I will seek it before the start of my project.	
☒ I confirm that my research does not include risks that might cause it to be excluded from coverage by the University's insurers.	
☒ I confirm that I have appropriate insurance for this research.	
Researcher's signature: M.MARSZALEK	Date: 31/01/2022
In addition, for **students** (undergraduates, masters, postgraduate, research): The student has the skills to carry out the proposed research. I undertake to monitor the student's adherence to the relevant research guidelines and codes of practice.	
Supervisor's signature: R.Lockley	Date: 01/03/22
2nd Supervisor's signature: Marina Brkljac, 02.03.2022	

Please submit this form along with Form 1 to your Faculty Head of RKE or nominee (staff /PGR) or your supervisor (taught postgraduate students).