Ethics and Trust in Virtual Currencies

Ethics & Trust in Finance
Global edition 2020-2021

Finalist

Bessie O'Dell
United Kingdom
DPhil Student,
*University of Oxford**
Oxford (United Kingdom)

* The views expressed herein are those of the authors and do not necessarily reflect those of the Organization she is affiliated with or of the Jury.

The rise and fall (and rise again) of virtual currencies

"Money makes the business world go round. Yet money is more than cash." (Dierksmeier and Seele, 2018, p. 1)

When we think about money, we often think about cash – tangible banknotes, coins, or an indication of current assets (which can be readily turned into cash). Money is at the centre of the financial world. It is used as payment for goods and services, for people and organisations to pay their taxes, for the repayment of debts, and for investment. Yet money is much more than cash. Indeed, emerging forms of money, such as virtual currencies, are presently enjoying a meteoric, if undulating, rise.

In May 2021, Dogecoin - a digital currency based on an internet meme, which was created by software engineers as a "joke" in 2013 - jumped in value by 30 per cent within 24 hours after being endorsed on Twitter by Tesla's CEO Elon Musk (Bambrough, 2021) (see *Figure 1*). Similarly, the renowned Bitcoin has enjoyed a spectacular rise since its inception in 2009 as an "electronic payment system based on cryptographic proof *instead of trust*," and an alternative to traditional financial instruments (Nakamoto, n.d.; emphasis added). Bitcoin has endured a volatile and undulating trading history since its inception, but still, its price climbed to a new high of $63,729.50 in April 2021. However, this success story has not come without criticism. Most notably, Nobel prize winning economist Paul Krugman went as far

as to denounce the cryptocurrency as "evil" in a 2013 article for *The New York Times*, arguing that it "remains completely unclear why Bitcoin should be a stable store of value" (Krugman, 2013). This opinion was shared by Benoît Cœuré, a member of the Executive Board of the European Central Bank (ECB), who has highlighted the "plentiful" problems of Bitcoin, describing it luridly as "the evil spawn of the financial crisis" (Jones, 2018).

The paradoxicality of virtual currencies

There is a degree of paradoxicality in Bitcoin describing itself as being based on cryptographic proof instead of trust. Arguably, trust is almost exactly what is required for a consumer to purchase, utilise, and especially to invest in, the decentralised, peer-to-peer cryptocurrency. As with all cryptocurrencies in circulation, Bitcoin is "not backed by any government or other legal entity" and is "not redeemable for gold or other commodity" (Gribberg, 2011). Therefore, its value is largely driven by speculative interest – hence its volatility. Bitcoin's inventor is also an unknown entity, with the original white paper outlining its conception written by "Satoshi Nakamoto", which is presumed to be a pseudonym, having never been credited to a particular individual. Yet Bitcoin continues to grow in popularity, alongside a host of other cryptocurrencies such as Ethereum and XRP. For example, in August 2019, 14 cryptocurrencies, ranging from Bitcoin and Litecoin to TRON, had a staggering market capitalisation of more than $1 bn (Giudici, Milne and Vinogradov, 2020.

The paradoxical nature of cryptocurrencies does not end there. On the one hand, such currencies have been credited with being a "solution to mitigate transaction costs and reduce poverty", as well as being "beneficial in the context of debt crises and hyperinflation" (Mbarek, Trabelsi and Berne, 2020, p.29). They might also provide additional personal and societal benefits, such as increasing people's financial autonomy. Technologically speaking, virtual currencies also allow for fast, secure, anonymous and international transactions, without relying on an intermediary such as a bank.

Conversely, virtual currencies have been beset by controversy and by links to unethical practices. Chief of these are claims that Bitcoin and related currencies have a significant, negative impact on the environment, stemming from the substantial amount of energy required for "data mining". Further concerns centre around the unethical use of cryptocurrencies, ranging from "virtual money laundering and tax evasion", to "the financing of illegal activities (i.e., illicit products, terrorist financing) and cyber attacks" (Mbarek, Trabelsi and Berne, 2020, p. 29).

Figure 1. The Dogecoin logo. 'Dogecoin' is an open-source peer-to-peer digital currency (cryptocurrency) which was originally created as a "joke" by software engineers Billy Markus and Jackson Palmer.

Despite a substantial number of news articles on the topic, there is very little academic literature focusing on the ethics of virtual currencies. One article (Mbarek, Trabelsi and Berne, 2020) provides a helpful overview of the virtuosity of virtual currencies and the environmental issues they raise. However, it lacks substantive critical content in several areas, with several topics only receiving a cursory nod. A systematic review conducted by Corbet, Lucey, Urquhart and Yarovaya (2019) also highlights a lack of focus on the ethics of virtual currencies. Of 92 studies surveyed, none tackled ethics. Conversely, the financial, technical, regulatory and behavioural aspects of virtual currency have been relatively well documented in the literature (see for example, Briere, Oosterlinck and Szafarz, 2015; Shin, 2008; Tu and Meredith, 2015; Wang and Mainwaring, 2008).

Similarly, despite virtual currencies being emerging, novel and largely unregulated technologies, there has been very little research examining the dynamics of trust at play. Ultimately, the underlying attributes of the technologies that drive trust in cryptocurrencies are not well understood (Marella, Upreti and Merikivi, 2020). Yet trust is clearly crucial to financial transactions and payments, as noted by Blommestein (2006, p.180): "without trust, financial markets cannot function efficiently."

This essay is therefore divided into two sections, and will seek to answer the following questions:

1. What are virtual currencies, and are they ethical?
2. To what extent are virtual currencies trusted, and should they be?

What are virtual currencies, and are they ethical?

Virtual currencies

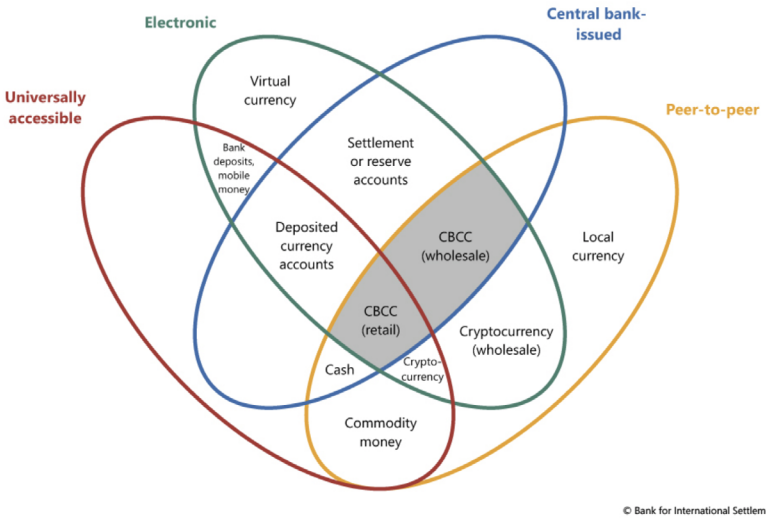
Virtual currencies are a type of digital currency which use financial technology (FinTech) and are a

virtual representation of money. Most commonly, they take the form of electronic "tokens" or "coins". They are also commonly referred to as "cryptocurrencies" which are in fact virtual currencies. The most well-known example of a virtual currency is Bitcoin, which explains why many commentators incorrectly assume that Bitcoin and virtual currency are one and the same.

By contrast, "digital currencies" is an umbrella term for any means of digital payment, which can include cryptocurrencies issued by private entities, central bank digital currencies and several other forms of digital money (Shi and Sun, 2020). They were introduced as a convenient way to carry out financial transactions globally, but also brings their own ethical and trust considerations, such as the potential introduction of central bank digital currencies (CBDC). Digital currencies are sometimes called "electronic money", "electronic currencies" or even "virtual currencies". Much of the discussion around digital currencies is in fact centred upon cryptocurrencies.

Virtual currencies often utilise, but are distinct from, electronic payments, which instead refers to payments using digital instruments. They bear the same functional properties as physical money, in that they can be used to make direct

Figure 2. The money flower: a taxonomy of money (Linnemann Bech and Garratt, 2017). Virtual currency is a universally accessible, peer-to-peer form of money, which intersects with (but is distinct from) central bank-issued forms of money



purchases of both services and physical goods, as well as be used online. However, virtual currencies do not have a physical location, and nor are they bound to a tangible asset, in the way that cash, for example, is backed-up by gold reserves. By contrast, virtual currencies make use of a complex cryptographic system. Within this system, the currency is located on a blockchain network, which functions as a digital ledger of transactions and a distributed system of recording information. The currency can be accessed using public and/or private keys stored on either a web-based or hardware-based digital wallet, such as on a computer or a mobile device. These are often referred to as "cryptocurrency wallets" or "crypto wallets", and crucially do not store the cryptocurrency or digital currency. The perceived benefits of virtual currencies are that they present a secure, fast and international mode of money transfer, without relying on an intermediary.

Ethics and virtual currencies

The Cambridge English Dictionary definition of "ethical" is something which relates "to the beliefs about what is morally right and wrong" (Cambridge English Dictionary, 2021). But what exactly does it mean for something to be morally right or wrong, and why might it be important for virtual currencies to be so? Can inanimate and indeed, digital objects hold a moral status, or is it ultimately the actions of humans that are under scrutiny? Furthermore, if something has both ethical and unethical attributes, such as a currency being simultaneously used to finance criminal activity and charity work, to what degree can it be considered "ethical"? Philosophers, particularly in the Western tradition, have discussed comparable questions throughout history. Plato, Aristotle and Hume all considered the question of whether there exists objective, rationally defensible standards of right action (Cottingham, 2008). The difference now is that ethical considerations are being applied in new ways to emerging technologies. As a result, new research fields have emerged, ranging from the philosophy of technology and computer ethics to machine ethics.

Discussion of the ethicality of virtual currencies is important. Firstly, it may be helpful knowledge for ethically minded people and organisations who might be considering using, investing, or being involved in the manufacture and distribution of virtual currencies. There are also real-world implications to consider. For example, in one empirical study, researchers used a text analytic approach to measure the extent to which "ethical" and "unethical" words were used in a discussion related to Bitcoin on Twitter, in order to determine whether there was a connection between ethics and cryptocurrency valuations. They found that the frequency of an

unethical discussion about Bitcoin was negatively associated with its price (Barth, Herath, Herath and Xu, 2020).

In this paper, we argue that virtual currencies, in the state that they presently exist, do not hold a moral status, and thus are not unethical or immoral or alternatively ethical and moral. Rather, ethical issues can arise from the use, or misuse, of such currencies. While there are many ethical issues that can, and should be considered, three key areas are highlighted below: the environment and energy use; broad social implications and blockchain ethics; and lastly, the ways in which blockchain technology can be, and is being, used to do good.

The environment and energy use

On 21 August 2018 Arvind Narayanan, an Associate Professor of Computer Science at Princeton University, provided written testimony to the United States Senate Committee on Energy and Natural Resources on the energy efficiency of blockchain and similar technologies. He described how for "most prominent public blockchains, mining involves the computation of a large number of mathematical calculations, called hashes, in parallel,". Thus, "substantial energy is required to operate the computing devices as well as to cool them to keep them within their operating temperature limits" (p.3). The extensive energy-intensive process required for "Bitcoin mining" involves important work being carried out to check all monetary transactions, which in turn creates Bitcoins as rewards.

It has been reported that the energy used to create Bitcoin alone is equivalent to the total energy consumption of the Netherlands, which has a population of 17.5 million. It is also equivalent to the annual carbon footprint of Argentina, as well as being comparable to Ireland's total electricity consumption (O'Dwyer and Malone, 2014).

The real-world impact of mining virtual currencies is already evident. For example, Iran recently (27 March 2021) announced a four-month ban on cryptocurrencies such as Bitcoin after several of its cities experienced unplanned blackouts, caused by energy-consuming mining. According to the BBC News (2021a), an estimated 4.5 per cent of all Bitcoin mining takes place in Iran, with President Hassan Rouhani detailing that 85 per cent of cryptocurrency mining is unlicensed and thus draining more than 2GW from the national grid each day. An assumption could therefore be made that, as well as having a detrimental environmental impact, data mining from cryptocurrencies is having a negative effect on some people's daily living conditions and potentially their happiness and wellbeing.

There are also long-term impacts to consider, the chief of which is climate change. Arguably,

humanity has a moral obligation to conserve the earth's ecosystem, both for the current generation and for those who follow. There are two main philosophical arguments as to why this might be the case. The first is that environmental conservation is important because of human dependence: that we need the earth and its human and animal inhabitants to both survive and thrive. Indeed, according to the former UN Secretary-General Ban Ki-moon, protecting the environment is an "urgent moral imperative", especially given that "climate change is intrinsically linked to public health, food and water security, migration, peace and security" (United Nations, 2015).

A secondary argument follows, whereby conserving the ecosystem is important for the ecosystem, which merits protection and nurturing, even in the absence of human need or dependence. The philosopher Aldo Leopold has argued that "a thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community; it is wrong when it tends otherwise"(Cottingham 2008, p.585). Many observers and commentators have taken issue with this position. For example, Kant argued that man has "no immediate duties towards animals, but rather our duties towards animals are merely indirect duties towards humanity" (Cottingham, 2008, p.576).

In any case, evidence suggests that the energy consumption of cryptocurrencies is such that it could have an impact on global warming. For example, one study in *Nature Climate Change* showed that projected Bitcoin usage, "should it follow the rate of adoption of other broadly adopted technologies, could alone produce enough CO2 emissions to push warming above 2 °C within less than three decades'" (Mora, *et al.*, 2018). Conversely, to some, the benefits of cryptocurrency outweigh the harm. For example, some people argue that Bitcoin derives most of its electricity from renewable energy sources (see for example, Frisby, 2021). However, this is not well documented in academic literature.

Social implications of virtual currencies

On 26 May 2021, the UK's Advertising Standards Agency (ASA) banned an advert by cryptocurrency company Luno which it deemed to be misleading. The ASA ruled that the advert omitted important risk warnings, and was "irresponsible" in encouraging inexperienced consumers to purchase Bitcoin. "We understood that Bitcoin investment was complex, volatile and could expose investors to losses", the ASA said. However, it continued, "that stood in contrast to the ad[vertisement]. The audience it addressed, the general public, were likely to be inexperienced in their understanding of cryptocurrencies" (BBC News, 2021b). Virtual currencies are ultimately "money

without institutions". They can bring with them some positive consequences, as discussed below. However, they can also present an ethical dilemma when targeted at naïve investors.

Virtual currencies have been linked to an array of sinister unethical behaviours and practices, ranging from virtual money laundering and tax evasion, to the financing of illegal products and activities, including terrorist financing, and to cyber-attacks. These practices are so widespread that they have spawned the term "crypto-crime". For example, cryptocurrencies are often used on the "Darknet" or "Darkweb", an overlay network within the Internet which is only accessible with specific software. Bitcoin, it has been argued, has become "the currency of choice for cybercriminals", given that "distinctive characteristics of decentralisation and pseudo-anonymity are also attractive to criminal actors in general" (Brown, 2016, p. 327). By extension, the Darknet seemingly facilitates this criminal activity.

Blockchain ethics: an opportunity for redemption?

Much of the concern around environmental and social impacts stems from the use of blockchain technology. This is because it is the feature of virtual currencies that is most energy intensive, and which also facilitates the type of unethical behaviour which thrives on anonymity. Historically, there has been a notable lack of research on blockchain ethics. However, there have been recent efforts to identify the ethical issues surrounding blockchain, and to propose a conceptual framework for blockchain ethics following discussion with stakeholders (Tang, Xiong, Becerril-Arreola and Iyer, 2020). In a systematic literature study on blockchain ethics, Hyrynsalmi, Hyrynsalmi and Kimppa (2020) highlight that "the area is swiftly maturing", yet there is a lack of usable ethical tools, methods and frameworks for blockchain ethics. Furthermore, their study shows that blockchain ethics discussion often remains artificial. They therefore call for more "concrete usable tools—for the practitioners and scholars", as well as a "deeper understanding of relevant ethical concerns" (p.145).

Some scholars have sought to highlight and understand the ways in which blockchain technology can be a source of social good and be used in ethically acceptable ways. For example, Lapointe and Fishbane (2019) consider how blockchain might allow for the expanding of access to services towards people who do not have formal identity credentials or credit history. As one example, BanQu's economic-identity blockchain "aggregates personal identifiers, such as financial transaction histories, property records, trust networks, and education records", so that people are able to "develop a portable and vetted personal history that gives

them access to formal services" (p.56). In addition, blockchain has the potential to be a force for good beyond banking and finance. For example, it could enable the protection of vital records in digital registries, enable secure mobile voting, help to prevent human trafficking, and improve medical research and healthcare (*ibid*).

Beyond academia, positive action is already being taken to steer virtual currencies in an ethical direction. For example, in May 2021, it was announced that a new Bitcoin Mining Council had been created in order to improve the cryptocurrency's sustainability, following a meeting of "leading" Bitcoin miners and the ever-present Elon Musk (BBC News, 2021c). Meanwhile, more ethical options for virtual currencies are becoming available, such as FairCoin (https://fair-coin.org), which claims to require "much less energy than other blockchains", while enabling faster transactions. As well as laying claim to very low power consumption, even with hundreds of transactions per minute, FairCoin also looks to support fair business values and models.

Furthermore, some commentators have argued that the focus on issues such as the dark side of the darknet has been overdone. For example, one qualitative study found that current academic studies and media reports tend to highlight how the anonymous nature of the Darknet is used to facilitate criminal activities. However, the characteristics of the Darknet also "provide a wide range of opportunities for good as well as for evil". This is enabled, they suggest, by various characteristics that are also seen to cause harm, but which are "rooted in the Darknet's technological structure", such as "anonymity, privacy, and the use of cryptocurrencies' (Mirea, Wang and Jung, 2019, p.102).

To what extent are virtual currencies trusted, and should they be?

Trust has been described as the "social glue" between the known and the unknown, and something which matters more than ever in the digital age (Botsman, 2017; 2020). In its most basic form, trust can be envisaged as a dyadic conception, focused on specific actions between people, where all parts are necessary. For example, "A trusts B to do X" (Hardin, 1996). Theoretically, this can also apply to dynamics which include non-human actors. Indeed, a concept identified as "e-trust" has been adopted by some researchers seeking to delineate the more generic ideal of "trust" from trust specifically developed in digital contexts and/or involving artificial agents (Taddeo and Floridi, 2011).

There are of course, many forms of trust, ranging from interpersonal trust (the perception that others will not harm your interests) to institutional trust (confidence in institutions). A related, yet distinct concept, is that of "trustworthiness" – the extent to which something

or someone is deserving of trust or confidence (Hardin, 1996).

What does it mean then to trust a virtual currency, or to find it trustworthy? Furthermore, what do we know about whether people trust virtual currencies? We might reason that in this context, there would be an expectation that the currency was fair, fit for purpose, and fulfilled its intended use or uses. These might include being secure, transferable and anonymous.

Considering the many news stories, and academic articles denouncing virtual currencies, one might think that this would affect how trustworthy they are considered to be, and how trusted they are in practice. Indeed, as Barth, Herath, Herath and Xu note (2020), consumers are sensitive to the ethicality of virtual currencies, and have been shown to respond negatively, with the price has falling, when a currency is perceived to be unethical. Yet despite these overarching concerns, many people continue to utilise, and invest in, virtual currencies, indicating some degree of confidence in their trustworthiness.

Original research now exists which seeks to understand and explain the trust placed in virtual currencies. For example, one research paper by Marella, Upreti, Merikivi and Tuunainen (2020) analysed 1.97 million discussion posts across several online forums related to Bitcoin, such as Cryptocurrency Talk and BitcoinTalk Forum. They found 11 different attributes related to three technology constructs that are significant in creating and maintaining users' trust in Bitcoin. These included security, stability, knowledge, regulation, decentralisation, investment, profitability, alternative currency, openness and transfer.

One key explanation for the trust placed in virtual currencies is the stark contrast they provide with traditional financial institutions, which suffered a particularly steep demise in trustworthiness following the 2007-2008 global financial crisis. Marella, Upreti, Merikivi and Tuunainen (2020) highlight that the use of cryptographic techniques increases the users' trust in cryptocurrencies, while traditional financial services benefit more from institutional trust. Thus, "in the absence of basic legal and institutional premises, cryptocurrencies demand trust, not in people but in technology, as the security of financial transaction depends upon the underlying technology" (p.261).

Conclusion

In exploring the ethics of virtual currencies, and the trust placed in them, this paper has sought to answer the following questions:

What are virtual currencies and are they ethical?

Firstly, we highlighted that several terms are often conflated with "virtual currencies", such as "digital currencies" and "cryptocurrencies".

Nonetheless, virtual currencies are a distinguishable concept in their own right; for example cryptocurrencies are simply a sub-type of virtual currencies. These distinctions matter, because different forms of digital currencies (the umbrella term for virtual currencies) present their own ethical challenges. We also showed how it is the underpinnings of virtual currencies, such as their use of blockchain technology, which largely give rise to ethical considerations.

We argue that virtual currencies ought not to be judged as possessing moral standing. Instead, it is their uses (or the individuals who use them in certain ways, who ought to be scrutinised. In answer to the question of whether virtual currencies are "ethical", we suggest that there is a complex interplay of both ethical and unethical practices and consequences when using virtual currency, including an array of environmental and social factors. While these factors are not intended to be a comprehensive list, they nevertheless highlight key areas of focus and contention.

Whether or not one understands something to be "ethical" when it possesses both ethical and unethical components will depend on one's philosophical and moral leanings. The important takeaway, however, should be that clearly unethical issues, such as environmental deterioration and financing of crime, ought to be addressed by issuers of virtual currencies. As highlighted, some work is already being carried out, for example with the creation of ethical cryptocurrencies such as FairCoin.

To what extent are virtual currencies trusted, and should they be?

Secondly, we sought to understand whether virtual currencies are trusted by users, and whether they should be. The substantial, continued rise in the popularity of virtual currencies, particularly, cryptocurrencies, indicates that people are trusting enough to either invest in, or at least experiment with the idea of, virtual currencies, whjch seem to provide an attractive alternative to traditional institutions and financial instruments. Furthermore, their volatility is well documented, and perhaps even expected. It remains to be seen whether virtual currencies *should be* trusted over time, and whether, as the memory of the global financial crisis fades, they will continue to be trusted. Perhaps they will continue their meteoric rise, in which case virtual currencies may one day be the "money [that] makes the business world go round.". •

References

Bambrough, B. (2021, May 14). Elon Musk Again Sent The Dogecoin Price Sharply Higher – After Revealing he 'Strongly Believes in Bitcoin and Crypto'. *Forbes*. Retrieved on 1 June 2021 from https://www.forbes.com/sites/billybambrough/2021/05/14/elon-musk-again-sent-the-dogecoin-price-sharply-higher-after-revealing-he-strongly-believes-in-bitcoin-and-crypto/?sh=7d001e5b28d8

Barth, J. R., Herath, H. S., Herath, T. C., & Xu, P. (2020). Cryptocurrency valuation and ethics: a text analytic approach. *Journal of Management Analytics*, *7*(3), 367-388.

BBC News (2021a, 26 May). Iran bans cryptocurrency mining for four months after blackouts. Retrieved on 1 June 2021 from https://www.bbc.co.uk/news/world-middle-east-57260829

BBC News (2021b, 26 May). 'Irresponsible' London Underground Bitcoin advert banned. Retrieved on 1 June 2021 from https://www.bbc.co.uk/news/business-57254318

BBC News (2021c, 25 May). Bitcoin Mining Council to report renewable energy usage. Retrieved on 1 June 2021 from https://www.bbc.co.uk/news/technology-57240090

Blommestein, H.J. (2006) How to Restore Trust in Financial Markets? In: Dembinski P.H., Lager C., Cornford A., Bonvin JM. (eds) Enron and World Finance. Palgrave Macmillan, London. Retrieved from https://doi.org/10.1057/9780230518865_11

Botsman, R. (2020). Trust Issues with Tracing Apps: What We Can Learn. *Newsletter: Rethink*. Retrieved on 30 Jan 2020 from https://www.linkedin.com/pulse/trust-issues-tracing-apps-what-we-can-learn-rachel-botsman/

Botsman, R. (2017). *Who can you trust?: how technology brought us together–and why it could drive us apart*. Penguin UK

Briere, M., Oosterlinck, K., and Szafarz, A. (2015). Virtual currency, tangible return: Portfolio diversification with bitcoin. *Journal of Asset Management*, *16(6)*, 365-373

Brown, S. D. (2016). Cryptocurrency and criminality: The Bitcoin opportunity. *The Police Journal*, *89(4)*, 327-339

Cambridge English Dictionary (2021). Ethical. Retrieved on 1 June 2021 from https://dictionary.cambridge.org/dictionary/english/ethical

CNBC (2021). Bitcoin hits new all-time high above $63,000 ahead of Coinbase debut. Retrieved on 1 June 2021 from https://www.cnbc.com/2021/04/13/bitcoin-hits-new-all-time-high-above-62000-ahead-of-coinbase-debut.html

Corbet, S. Lucey, B. Urquhart, A. and Yarovaya, L. (2019). Cryptocurrencies as a financial asset: A systematic analysis. International Review of Financial Analysis, Elsevier, vol. 62(C), pp: 182-199

Cottingham, J. G. (Ed.).

(2021). *Western philosophy: An anthology*. John Wiley & Sons

Dierksmeier, C., Seele, P. Cryptocurrencies and Business Ethics. *Journal of Business Ethics 152*, 1–14 (2018). Retrieved from https://doi.org/10.1007/s10551-016-3298-0

Frisby, D (2021). Bitcoin does consume a lot of energy – but here's why it's worth it. *Money Week*. Retrieved on 1 June 2021 from https://moneyweek.com/investments/alternative-finance/bitcoin/602678/bitcoin-energy-consumption

Grinberg, R. (2012). Bitcoin: An innovative alternative digital currency. *Hastings Science and Technology Law Journal, 4*, 159

Giudici, G., Milne, A. & Vinogradov, D. Cryptocurrencies: market analysis and perspectives. *Journal of Industrial and Business Economics, 47, 1*–18 (2020). Retrieved from https://doi.org/10.1007/s40812-019-00138-6

Hardin, R. (1996). Trustworthiness. *Ethics*, *107(1)*, 26-42

Hyrynsalmi S., Hyrynsalmi S.M., Kimppa K.K. (2020). Blockchain Ethics: A Systematic Literature Review of Blockchain Research. In: Cacace M. et al. (eds) Well-Being in the Information Society. Fruits of Respect. WIS 2020. *Communications in Computer and Information Science*, *vol 1270*. Retrieved from https://doi.org/10.1007/978-3-030-57847-3_10

Jones, C. (15 Nov 2018). ECB official dubs bitcoin 'evil spawn of the financial crisis.' *Financial Times*. Retrieved on 1 June 2021 from https://www.ft.com/content/92c4737e-e8ed-11e8-885c-e64da4c0f981

Kant, I. The Status of Non-human Animals. In Cottingham, J. G. (Ed.). (2021). *Western philosophy: An anthology*. John Wiley & Sons (pp. 576-579)

Krugman, P. (28 Dec 2013). Bitcoin is Evil. The New York Times. Retrieved from https://krugman.blogs.nytimes.com/2013/12/28/bitcoin-is-evil/?_r=0

Lapointe, C., & Fishbane, L. (2019). The blockchain ethical design framework. *Innovations: Technology, Governance, Globalization*, *12 (3-4)*, 50-71

Leopold, A. Our Relationship to the Environment. In Cottingham, J. G. (Ed.). (2021). *Western philosophy: An anthology*. John Wiley & Sons (pp. 585-590)

Linnemann Bech, M. and Garratt, R. (Sept 2017) Central bank cryptocurrencies. *BIS Quarterly Review*, Bank for International Settlements

Marella, V., Upreti, B., Merikivi, J. *et al.* Understanding the creation of trust in cryptocurrencies: the case of Bitcoin. *Electron Markets 30*, 259–271 (2020). Retrieved from https://doi.org/10.1007/s12525-019-00392-5

Mirea, M., Wang, V. & Jung, J. The not so dark side of the darknet: a qualitative study. *Security Journal 32*, 102–118

(2019). Retrieved from https://doi.org/10.1057/s41284-018-0150-5

Mora, C., Rollins, R. L., Taladay, K., Kantar, M. B., Chock, M. K., Shimada, M., & Franklin, E. C. (2018). Bitcoin emissions alone could push global warming above 2 C. *Nature Climate Change*, *8(11)*, 931-933

Nakamoto, S. (n.d.). Bitcoin: A Peer-to-Peer Electronic Cash System. Retrieved from https://bitcoin.org/bitcoin.pdf

O'Dwyer, K. J., & Malone, D. (2014). Bitcoin mining and its energy footprint. Conference: 25th IET Irish Signals & Systems Conference 2014 and 2014 China-Ireland International Conference on Information and Communities Technologies (ISSC 2014/CIICT 2014). Doi: 10.1049/cp.2014.0699

Scharding, T. (2019). National currency, world currency, cryptocurrency: A Fichtean approach to the Ethics of Bitcoin. *Business and Society Review*, *124(2)*, 219-238

Shi, Q., & Sun, X. (2020). A Scientometric Review of Digital Currency and Electronic Payment Research: A Network Perspective. Complexity (2), 1-7.

Shin, D. H. (2008). Understanding purchasing behaviors in a virtual economy: Consumer behavior involving virtual currency in Web 2.0 communities. *Interacting with computers*, *20(4-5)*, 433-446

Taddeo, M., & Floridi, L. (2011). The case for e-trust. *Ethics and Information Technology*, *13(1)*, 1-3

Tang, Y., Xiong, J., Becerril-Arreola, R., & Iyer, L. (2019). Ethics of blockchain. *Information Technology & People*. Doi: 10.1145/3322385.3322397

Tu, K. V., & Meredith, M. W. (2015). Rethinking virtual currency regulation in the Bitcoin age. *Washington Law Review*, *90*, 271-347

United Nations (28 April 2015) Protecting Environment is 'an Urgent Moral Imperative', Sacred Duty For All People of Faith. *Meetings Coverage and Press Releases*. Retrieved on 1 June 2021 from https://www.un.org/press/en/2015/sgsm16710.doc.htm

Wang, Y., & Mainwaring, S. D. (April 2008). Human-Currency Interaction: learning from virtual currency use in China. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 25-28)