HAYVN
RESEARCH

Episode 6: Crypto enables the E, S, and G in ESG

Introduction

Environmental and social governance (ESG) has become a ubiquitous term that has altered the investing landscape, attracting both capital and scrutiny. The sector has amassed up to $2.7 trillion in assets under management, managed by over 3,000 ESG funds. Projected to reach $50 trillion by 2025, ESG investing is a paradigm shift. Cryptocurrency, whose market capitalisation reached a peak of $3 trillion, has naturally had its role in the ESG framework questioned, with most critics shutting it down for its large energy consumption.

The most recent years have accommodated a cryptocurrency bull market that once again threw crypto into the spotlight. The added attention has resulted in equal resistance from regulators concerning the climate impacts of cryptocurrencies such as bitcoin and ethereum. Estimates vary, though the bitcoin network emits a carbon footprint of more than 60 megatons of CO_2 annually, comparable to the carbon footprint of Switzerland. However, as we will discuss, these comparisons are one-sided, as little attention has been paid to the positive environmental effects of cryptocurrency.

Being ESG conscious is of course a vitally important consideration financial participants should be aware of if we are to transition to a sustainable world, but the space is not exempt from criticism. Asset managers and financial institutions have, at times, been inclined to present themselves as environmental saviours. There are systemic problems with the ESG movement. A paper from the University of Hong Kong pointed to the fact that the lack of robust data authentication, consistency, and transparency makes ESG evaluation inadequate. Blackrock's former CIO, Tariq Fancy, has gone on record blasting Wall Street for "greenwashing the economic system, and in the process creating a deadly distraction." A lack of standardised ESG ratings and a general lack of transparency around ratings practices makes it difficult for the movement to gain legitimacy. These issues are due to unique centralised systems that don't share data, allowing institutions to cherry-pick the data they wish to share.

ESG extends beyond just solving the climate crisis. Socially inclusive protocols and sound governance structures can improve the quality of life of many while decreasing the possibility of institutional malpractices. These together can have reinforcing effects on the environmental aspect.

In this chapter, we will outline the energy considerations as they relate to the cryptocurrency industry. We will first consider the environmental impacts of the blockchain, and if it is indeed the pollutant technology many claim it to be. We then turn to the contributions cryptocurrency can have on social considerations, before discussing the particulars of a new type of governance. Together we show how in fact, the blockchain can be the enabler of the green, socially conscious transition.

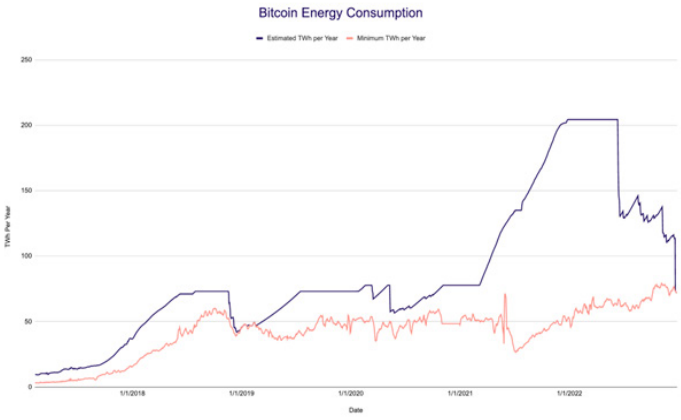
Is Cryptocurrency Environmentally Friendly?

Different blockchains operate with different consensus mechanisms, that in turn require differing amounts of energy to keep them operational. Bitcoin, the first decentralised blockchain, makes use of a proof-of-work mechanism, making it one of the most energy-intensive blockchains. Ethereum on the other hand, with its recent switch to a proof of stake mechanism following the merge, consumes about 98% less energy than it used to when it used proof of stake. However, any analysis of energy consumption must be paired with any analysis of energy contribution. The solar industry's net benefit contribution, for example, is well known. The clean energy it creates can be added to the fossil fuel energy it takes to melt the silicon needed for the assembly of turbines.

Proof of Work

To secure proof of work blockchains, validators known as miners solve computationally expensive problems in order to be awarded the block that is added to the chain, in turn receiving cryptocurrency as a reward. Proponents of the bitcoin network advocate for this tangible linkage to real world resources, claiming that bitcoin's properties are not probabilistic but deterministic[1]. With work being the arbiter of truth, this connection to the natural physical world is thought to be a reliable and secure monetary technology that can capture the majority of the store of value energy in the monetary world.

To determine the electricity consumption of a cryptocurrency network such as bitcoin, popular indexes will look at miner revenues, and assume some part of the revenue is spent on electricity. Typically, in equilibrium[2], operational costs are estimated to be approximately 60% of miner revenues. Miners pay a certain cost per kilowatt-hour, therefore the next step would be to determine how many kilowatt-hours were consumed for every operational dollar spent – converting the cost to consumption. The chart below shows bitcoin's energy consumption.



Source: Bitcoin Energy Consumption

The energy required to power the Bitcoin network is indeed enormous, currently at approximately 72 TWh per year, equal to the electricity consumption of Colombia. Approximately 510,000 Visa transactions could be processed with the energy required to process a single bitcoin transaction.

This has led to the network becoming the subject of environmental concerns, with critics slamming it as an unsustainable and inefficient store of value. Furthermore, while big-tech companies have made it into the most popular ESG ETFs such as the iShares ESG aware index, bitcoin and other cryptocurrencies have been excluded from the ESG investable universe.

The highly lauded ESG criticism however is not spared from further consideration. There is evidence that proof-of-work mechanisms have embedded incentives that are environmentally positive. Daniel Batten proposed in his study: 'Quantifying the Potential Impact of Bitcoin Mining on Global Methane Emissions,' that proof-of-work mining is one of the rare industries that have an existing incentive structure that encourages the reduction of methane emissions without the need for any behaviour changes or government directives. Methane, over a 20 year period, has had 84 times the global warming effects of carbon dioxide. By combusting leaking methane, miners can eliminate 5.32% of all global emissions by 2045, representing 23% of all global methane emissions. Miners can combust methane from flared gas from the oil and gas industry, landfills, orphaned oil wells, or biogas[3]. Landfills leak methane from the decomposition of organic matter. Some landfills attempt to capture the methane and use it for energy, though many smaller landfills don't have economic usage for the methane and rather let it leak into the atmosphere. Bitcoin miners are the few that are flexible enough to take advantage of medium-sized landfills.

The Intergovernmental Panel on Climate Change (IPCC) stated that the 1.5 degrees celsius target cannot be achieved without reducing methane emissions by 45% to 50% by 2030. This means that bitcoin mining has the potential to achieve half of the methane reduction target as laid out by the IPCC.

Digital asset miners have also used stranded natural gas to power their infrastructure, where the volumes of gas are too low to justify the producer building out a pipeline – a cost of about five million dollars per mile. Using these sources of energy is thus infeasible for many alternative options such as the heating of residential homes or hospitals, as the power would need to be transported by either pylon transmitted electricity, or gas pipelines. Of the services that are mobile enough to set up shop in these remote locations, bitcoin and data centres are the few candidates. Data centres however are not fully interruptible, in that variable energy generation or shutdowns would substantially affect their services. Miners are mobile, and can at any time

[1] Some properties such as the variation of block intervals in proof of work, exhibit probabilistic characteristics, but in general, every node in the network will verify the same transaction order. A difference in any of the nodes for the same operation would result in failed consensus.

[2] Producers take time to respond to price shifts, as the time it takes for new, energy-intensive mining infrastructure to come online can be substantial. Popular indexes assume that new rigs will continue to come online as long as it is profitable to do so, until an equilibrium is reached.

stop validating transactions while having a minimal impact on the network. This is also beneficial to producers, who are able to sell their gas rather than waste it, thus getting higher ESG scores.

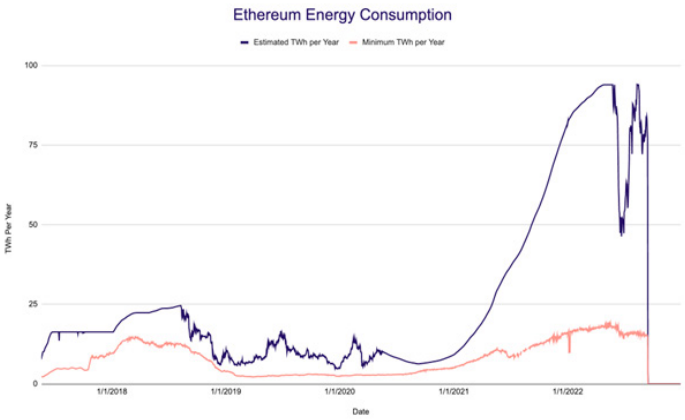
There are of course alternative methods to reducing methane emissions, though the unique proposition that bitcoin mining offers is that it is location-agnostic, interruptible, and requires no bureaucratic instruction or regulation. The Environmental Protection Agency (EPA) echoes this view saying that incentives are vastly more favourable to mitigate methane pollution than regulation.

Miners have also been known to contribute to electric grid stability. Tokyo Electric Power Grid announced recently that it is working with local rig manufacturers to capitalise on excess power from its grid. Electrical grids have, as characteristics, variable supply and variable demand. Some sources, such as nuclear power, are very stable. Others, such as wind or solar, are the jurisdiction of mother nature. This variability means supply needs to be overbuilt to meet the energy needs of the population when supply is low. Surplus energy, through proof of work miners, can be monetised rather than wasted.

Proof of Stake

Proof of stake consensus mechanisms are ones that depart from using the physical world as evidence for work, and instead turn to fiscal incentives. Validators secure the network by staking their crypto, but critically do not require intensive amounts of energy to validate transactions. To determine which node will be granted the transaction blocks, proof of stake protocols mostly incorporate: the amount of time tokens have been staked, the fiscal value staked, and a randomised process. Introducing randomness avoids centralisation, while the other variables are weighted in order to tilt the favour to those with the most and longest staked tokens. This incentive mechanism has resulted in a system that uses approximately 99% less energy than proof of work. The Ethereum network recently completed its transition to a proof of stake mechanism, and saw a 99.9% reduction in energy consumption, making it approximately 2000 times more efficient than proof of work mining. The dramatic drop off is shown below.

[3] Sources of biogas can include manure from animal based farming activities, wastewater, or waste from food and beverage production.



Source: Ethereum Energy Consumption

Other consensus mechanisms exist, but are mostly some variation of the above. Solana's network for example has most of the mechanisms of proof of stake, but within their novel proof of history generator that supplies a verifiable passage of time to the blockchain.

Social Considerations

Having discussed cryptocurrency's environmental costs and benefits, we will now turn to how blockchain technology can help build practices that positively impact society.

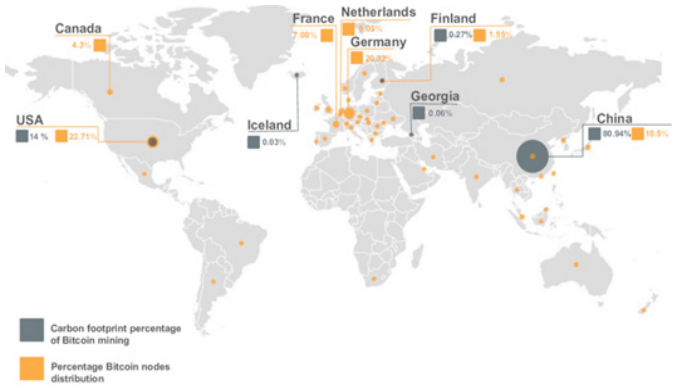
Social Principles – The Open Source Way

How a company manages relationships with its employees, community, and stakeholders, forms the social considerations that it must be held accountable to. Cryptocurrency as an industry is built on fundamental principles of transparency, trust and security. There have of course, as in any industry, been sour businesses that become opaque and misleading with the determination to deceive a community and profit from their ignorance. These bad actors take advantage of the scant regulation of new technologies, but are in truth far removed from what the blockchain offers.

Bitcoin is a payments processing blockchain that is completely public, secure, and trustless. Building on this innovation, smart contract networks such as Ethereum offered the programmatic execution of logic via autonomous code, providing the automatic enforcement of agreements. Fundamentally, this technology stands for transparency, as stakeholders can use blockchain explorers to view all transactions on public blockchains. Similarly, anyone can call a smart contract or view its functions. While a company's expenses and liabilities are likely still stored on internal databases, it is a significant leap forward in transparency that allows users to view the company's assets and transactions on a public ledger.

For the most part, blockchains are open-source software – code that are purposefully made available to the public for viewing, modification and use. The principles of open-source software are transparency, collaboration, and community. In this, a sort of meritocracy is created whereby the best ideas from a diverse set of contributors are allowed to win. This is also a major contributor to diversity inclusion, as most blockchain projects are truly borderless – operating outside of formal jurisdictions. Developers and community members from around the world, without prejudice, are able to contribute to projects of their choosing. Common places of collaboration in the crypto community include Github, Gitlab, Discord, Telegram, Twitter and Reddit. As mentioned in our chapter on smart contract platforms, these community members are often rewarded with tokens, creating a pool of human capital that is incentivised to propel the project forward.

The chart below shows the distribution of nodes that are verifying the bitcoin network from around the world – such a wide dispersion of geographies can be seen with most blockchains, and the projects that are built on top of them.



Source: Bitcoin and Global Climate Change

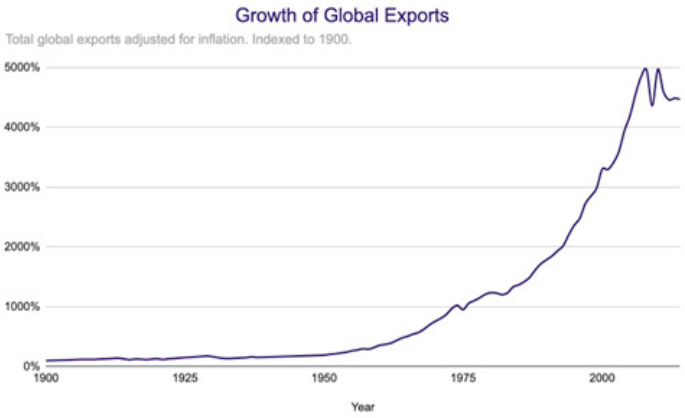
Human Rights

This brings us to the context of human rights, especially as they pertain to the digital world. A highly contentious topic in the digital age is the right to privacy and the ownership of data. Our lives have become embedded in technological advancements that both rid us of inconveniences and invade a fundamental human right – privacy. An important contribution of blockchain technology is that it allows corporations to disseminate data in new and privacy-respecting ways.

Decentralised Identity (DID) relates to self-sovereign identity as enabled by the blockchain. Creating encrypted digital proofs that verify identity in a way that respects the user's data and privacy is immensely important. An immutable, timestamped digital record is an improvement on the identity protocols that are currently widely used – that mostly involve third party verification. As an example, analysing someone's signature in a courtroom is a common method of verifying identity as it pertains to contractual agreements. Online digital signature companies have thus sprung to popularity as most contracts are agreed upon online. The data however is still stored on virtual or local servers owned by the third party that offers these services. Creating open standards that provide a trustless way of verifying identity can give individuals the choice as to what information is shared when interacting with the web, services, or other users. Javelin Strategy and Research have estimated that identity theft cost up to $52 billion in damages in 2021.

Supply Chains

The past four decades have seen an acceleration of trade globalisation due to technological improvements, lower barriers to trade, and a period of widespread economic and political integration. It is now extremely common for the manufacturing of a product to be done offshore, with raw materials sourced from many different countries, and sold to consumers all over the world.



Source: Federico and Tena-Junguito, HAYVN derivations

The drive to reduce costs however has led to the exploitation of workers, especially further up the supply chain. The Universal Declaration of Human Rights (UDHR) and the International Covenant on Civil and Political Rights (ICCPR), signed by over 170 nations, explicitly prohibit forced or compulsory labour. However, at least 28 million people around the world are victims of forced labour, the highest figure in history.

We won't immediately jump to 'bitcoin fixes this,' as solving the exploitation of workers is a complex endeavour, large in scope. However, the blockchain can offer two vital features that could help supply chains become more socially conscious: traceability and transparency. Such a

supply chain is one that offers verifiable transparency to every upstream stakeholder that contributes to the production process. This enables corporations and governments to accurately identify the presence of socially unacceptable behaviour. Without this, sourcing of materials from manufacturers with poor treatment standards could be easily hidden in off-book subsidiaries. For example, mines located in geographies that have a positive water balance[4] are exceptionally dangerous for the workers of that mine. Tailings dams that store byproducts of mining activities have to essentially be guaranteed in perpetuity, or can become hazardous. Brazil has seen numerous tailings dam failures that have claimed hundreds of lives, the most recent example being the Brumadinho disaster. Yet, subtleties such as these are often not known further up the supply chain. The supply chain opaqueness that we have at present makes it harder for end-user companies to hold suppliers to adequate human rights standards.

Banking the Unbanked

Up to 38% of the global population is without access to financial services. Financial services such as banking, insurance, investment products and payments methods have become essential for sufficient integration into a modern life – one that allows for equality of opportunity. Decentralised Finance (DeFi) is a borderless system for offering financial services on the blockchain. Participation is pseudonymous – identities are anonymous but all actions can be linked to a user's address. The field is still evolving, and such a lack of clarity of identity stands in stark contrast to how the financial system currently operates. Also, much of DeFi activity has thus far focused on trading and lending services, which can oftentimes promote gambling rather than financial inclusivity. Still however, anyone with an internet connection can partake in these services, borrow or lend money, invest in cryptocurrency, or even get exposure to traditional assets through synthetic instruments. For a more thorough dive into how crypto can solve these problems, view our chapter on decentralised finance.

Governance

A standard that is the product of hundreds of years of corporate evolution is the formation of governance structures. This includes a publicly verifiable board of directors, and a separation between the board, shareholders, and management, to ensure there is a division of power. This however is often not enforceable, and is left to the devices of the managing team. Furthermore, private companies and the way they implement their structures are often not transparent.

When there are no adequate governance structures in place, certain individuals can act beyond their authority, with little accountability. The FTX and Alameda bankruptcy is a glaring example of this, where a small group of insiders reserved all decision making power, leading to insufficient risk controls.

The blockchain has brought about new and interesting ways of incorporating corporate governance. Governance topics, such as protocol developments, directors, or treasury management, can be voted on by token holders. The degree to which this occurs is protocol dependent, with most protocols starting off centralised before gradually becoming more and more decentralised – some becoming decentralised autonomous organisations.

Risk Mitigation and Accountability

Crypto can take governance beyond just having a diverse board. It can embed meritocracy, democracy and more equal practices throughout the organisation. Bridgewater Associates, the largest hedge fund in the world explores many of these methods, albeit without the blockchain. Fund founder Ray Dalio has introduced methods of collaboration, whereby all voices are believability weighted, regardless of seniority. Meetings are public, and the core ethos is that everyone knows something you don't. Forbes also writes about how decentralised governance can open doors to new opportunities with a team constantly expanding its capabilities. Blockchain and decentralised organisations are taking these ideas mainstream, with built in idea proposal systems and voting mechanisms.

These systems are transparent and traceable, and thus ideal for ensuring accountability throughout the organisation. Where there is accountability and diversity of authority, there is a much higher probability that significant risk mitigation controls will be put in place.

[4] A positive water balance is where rainfall and snow exceeds evaporative laws, typical in tropical and subtropical climates.

Conclusion

Cryptocurrency and blockchain technologies are still in their infancy, experiencing high bouts of volatility and extreme cyclicality. Moving forward however, one can ignore the speculative excess enabled by centralised exchanges and lending protocols, and rather look toward adopting these technologies for the efficiencies they offer.

Going forward, it is vital that progress is made in certain areas to contribute to an ESG conscious world. Digitised and cryptographically secured online identity systems are key to ensuring privacy and data protection. Blockchain enabled security, and the immutability of the technology will offer better tracking and tracing of supply chains. Data can be shared safely, and where the data is sensitive, cryptographic methods such as Zero-knowledge technology (verifying the data is true without sharing it) can be utilised. Industry wide collaboration with open-source principles can lead to standardised ESG measuring practises, as well as standardised reporting metrics. Both of which are vital to even measure progress.

In any event, a sizable portion of bitcoin's energy consumption is sourced from energy that is otherwise stranded or wasted. Since miners have the unique ability to set up in remote locations with variable power supply, they tend to be attracted to cheaper energy. This is especially true during bear markets, where miner profitability is reduced, and miners are harder pressed to find cheaper sources to power their rigs.

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