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Decarbonizing Bitcoin: Law and policy choices for reducing the energy consumption of Blockchain technologies and digital currencies

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ABSTRACT

The vast transactional, trust and security advantages of Bitcoin are dwarfed by the intentionally resource-intensive design in its transaction verification process which now threatens the climate we depend upon for survival. Indeed Bitcoin mining and transactions are an application of Blockchain technology employing an inefficient use of scarce energy resources for a financial activity at a point in human development where world governments are scrambling to reduce energy consumption through their Paris Agreement climate change commitments and beyond to mitigate future climate change implications.

Without encouraging more sustainable development of the potential applications of Blockchain technologies which can have significant social and economic benefits, their resource-intensive design combined now pose a serious threat to the global commitment to mitigate greenhouse gas emissions. The article examines government intervention choices to desocialise negative environmental externalities caused by high-energy consuming Blockchain technology designs.

The research question explores how to promote the environmentally sustainable development of applications of Blockchain without damaging this valuable sector. It studies existing regulatory and fiscal policy approaches towards digital currencies in order to provide a basis for further legal and policy tools targeted at mitigating energy consumption of Blockchain technologies. The article concludes by identifying appropriate fiscal policy options for this purpose, as well as further considerations on the potential for Blockchain technology in climate change mitigation.

1. Greenback or back to green: how green is your digital currency?

1.1. Bitcoin threatens our existence while Blockchain can benefit us

The purposefully energy-intensive design of many Blockchain[1] technologies [1,2] means that combined they now pose a serious threat to the global commitment to mitigate greenhouse gas emissions (GhGs) pursuant to the Paris Agreement [3]. One of the many adoptions of Blockchain technology has been in financial technology such as digital currencies, the most famous being Bitcoin [4].[2] Despite digital currencies providing considerable potential transactional, security [5], and financial access benefits [6], the design of Bitcoin's mining and trading system requires such a vast consumption of electricity that it is equivalent to powering Denmark [7]. This threatens the planet to the extent that intervention is necessary to prevent similar models emerging. Even the processes involved in a single Bitcoin transaction could provide electricity to a British home for a month [8,9], with environmental costs socialised for private benefit [10].

Indeed the libertarian promise[3] [11] of a decentralized and secure

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[1] "Blockchain is a type of distributed ledger, comprised of digital records of transactions or assets, accessible to and trusted by all participants running the same protocol…. The fundamental innovation of blockchain is that it creates a means of establishing and maintaining consensus among the participants in a transaction without the need for either an established trust relationship or a central intermediary." See [1].

[2] For a background of its functionality, see Part I of A. Welch [4].

[3] See [11] at p. 6.

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peer-to-peer payments system [12] have largely been substituted with the speculative pursuit of private wealth creation with little social utility [13].[4] The problem will only worsen. The higher the value of Bitcoin, the greater the incentive to mine, and new digital currencies will be developed with similar carbonized models. Giungato et al. demonstrate that Bitcoin's system has been designed to require even greater computational power and therefore energy consumption to be mined in future.[5] Bitcoin has been designed with no consideration of its environmental impact. This is an inefficient use of scarce economic resources at a time when world governments are seeking to reduce energy consumption [14].[6] However, as the underlying technology can offer significant benefits, it is here to stay, so future models must be designed without reliance on energy consumption so disproportionate to their economic or social benefits.

1.2. How can we encourage tech to develop decarbonised Blockchain?

Nevertheless, the financial [15] and multi-sectoral [16,17] utility benefits of Blockchain technology are potentially enormous, with skilled job creation, investment and wealth creation going hand in hand with considerable advances in security and applications that can produce innumerable functions to benefit society, industry, and governance [18]. Blockchain technology has been advocated as being capable of delivering environmental and social benefits under the UN's Sustainable Development Goals [19]. It has already proven itself to be useful across a range of sectors including the financial technology sector. Financial technology is one sector that ought to be encouraged and facilitated, given its significant potential for economic gains and social utilities [20]. It is a paradigm shift in the economic structure of the market, the way transactions are carried out, and the way wealth is held. Nations discouraging Blockchain innovation will miss out on the infancy of the industry and the future benefits it brings once it is established, and those jurisdictions focusing upon restricting digital currencies will not prevent it from becoming universally accepted but will miss out on the benefits of its growth.

The question is how to encourage a shift to less energy intensive Blockchain technology without damaging the sector. Any market interventionist measure into the industry developing Blockchain technologies ought to be clearly measured to avoid harming or discouraging the financial technology sector or, indeed, the cryptocurrency industry per se.[7]

1.3. Research design

The article's research question examines how to desocialise the environmental costs of Blockchain technologies in a manner that will incentivize the development of a less energy intensive means of wealth creation, without discouraging the industry overall [21]. This could produce far-reaching benefits not just in terms of the development of an environmentally sustainable and profitable financial technology sector but it could go further in directing the technological innovators towards climate mitigation goals. The approach is structured as follows.

1.3.1. Rationale for market intervention

Prior to any exploration of government intervention choices, the article reviews compelling reasons why market failure is causing negative climate implications. Building on existing scholarship, this section identifies that technological advancements that were expected to produce positive results are now threatening our existence. Drawing upon the global programme for climate change mitigation and international principles of environmental law, it then provides a reasoned argument why a failure to intervene in the design of Blockchain technologies is not an option. This invokes key debates in economic and legal philosophical theory as well as international environmental law principles and global agreements. Word constraints limit this section, which is indeed an article in itself, so only a summary is provided.

This section points out that perversely taking no action means we are actually subsidisizing high energy-consuming technology and causing future developers to follow the same harmful path. It provides an explanation of the rationale for the internalization of negative environmental costs in order to reduce energy consumption of Blockchain technology applications. This is needed prior to any meaningful discussion of policy choices to achieve such internalization to promote behavioural change in the type of technology being designed.

1.3.2. Existing policy choices

Existing policy measures towards Blockchain technologies have focused upon one segment of their uses, namely digital currencies. This has included both regulating their use and consequently taxing their ownership. As the only precedent available of policy measures towards Blockchain technologies, this section analyses how the law has managed in differing jurisdictions to bring digital currency ownership within charge. Understanding this makes it possible to consequently determine how fiscal policy tools can apply to other applications of Blockchain technology in order to internalize negative externalities.

This first requires a qualitative assessment of case law, regulatory decisions, and policy to determine how regulators are to legally define digital currencies, before providing an overview of methods to bring them within the purview of the tax code. This shows that existing approaches have commonly utilized regulatory tools at first and followed this up with fiscal tools including taxes. Having brought this form of financial technology within the jurisdiction of taxation, this dual regulatory and fiscal approach provides an established path for further fiscal tools to incentivize reduced energy consumption Blockchain technology design.

1.3.3. Policy choices

After establishing how the law has managed to classify digital currencies and consequently receive revenue from them, the article enables an understanding of the legal and policy options available for environmental cost internalization and how they could be associated with existing taxes. The article then evaluates possible fiscal tool options upon Blockchain technology generally, that both facilitates digital currencies but also other utilities such as smart contracts [22].[8]

The article concludes by identifying appropriate fiscal policy options for this purpose, as well as further considerations on the potential for Blockchain technology to achieve climate change mitigation. The implications of the findings are global, with the intention to present policy tools available to different lawmakers depending on the reality of the situation. As such the article is not focused upon any particular jurisdiction and takes examples from various States.

[4] Joseph Stiglitz [13]: "[Bitcoin] doesn't serve any socially useful function" and "[Bitcoin] out to be outlawed."

[5] Since the majority of Bitcoins have been mined already. Bitcoin's "system has been built in a way almost like the mining of a natural resource: costs and efforts rise as the system reaches the ultimate resource limit…the "mining" of new bitcoin requires more and more hardware resources necessary to "mine" each bitcoin when approaching the capped limit of the bitcoin system." [14].

[6] As argued by Jeff Spross [15]. See also [11] at p. 3.

[7] The author is grateful for the advice in helping define the topic of Dr. Raphael Brown, Law Professor and Researcher at the Centre for Law & Development, Qatar University.

[8] "The idea of smart contracts is that by formulating contractual arrangements between parties into computer code format and storing them into a blockchain, contracts can be made tamperproof, self-executing and automatically enforceable." [23].