Blockchain and Environmental Sustainability: Case of IBM's Blockchain Water Management

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Discussion Paper

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Abstract: This discussion paper considers the role that blockchain-based technologies can play in advancing initiatives pertaining to environmental sustainability, using the case study of IBM's water management blockchain development in California. The paper finds that there is substantial room for incorporating blockchain technology into environmental protection and sustainability projects, including in the mitigation of information asymmetry through transparency so as to foster stronger market-mechanisms in the allocation of resources.

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Blockchain and Environmental Stability: Case of IBM's Water Management

As an area of recent disruptive innovation that has spurred a groundswell of public interest, cryptocurrencies and blockchain technology have, in addition to their research-based appeal,[3] also excited practitioner interest in many environmental fields. The aim of this paper is to discuss the scope for including and incorporating blockchain-based technologies into initiatives pertaining to environmental protection and sustainability, using the case study of IBM's water management blockchain-based project in California (2018). This discussion will point towards a fruitful avenue for the deploying blockchain technology towards addressing important socio-environmental goals.

A blue-chip technology giant with a century-long record of bringing important computerized innovations to the fore, IBM has now taken a leading role in presenting real-world practitioner examples of blockchain technology application. In addition to its environmental focus, it has also invented blockchain-based approaches towards tracking ethically-sourced minerals and overseeing food supply chains. In partnering with a non-profit foundation focused on freshwater ecosystem restoration and protection known as The Freshwater Trust (TFT); as well as low-cost satellite sensor provider SweetSense Inc., IBM has piloted blockchain and IoT technologies for the monitoring and oversight of groundwater usage in California's Sacramento-San

[3] see also discussions in Decourt et al., 2017; Chohan 2017a, 2017b, 2017c, 2017d, 2017e, 2017f, 2017g, 2017h, 2017i, 2017j, 2017k, 2017l, 2017m, 2017n, 2017o, 2017p, 2017q, 2017r, 2017s, 2017t, 2018a, 2018b, 2018c, 2018d, 2018e, 2018f, 2018g, 2018h, 2018i, 2018j, 2018k, 2018l, 2019a, 2019b, 2019c, 2019d, 2019e, 2019f, 2019g, 2019h, 2019i

Joaquin River Delta, which hydrologists consider to be the nexus of California's statewide water system, and is one of the largest and at risk aquifers in North America. IBM has also incorporated other stakeholders including the University of Colorado at Boulder, which will provide additional research support, and funding from non-governmental organizations including the Water Foundation and the Gordon and Betty Moore Foundation.

The aim of the project's scientists and engineers is to lay a demonstration of how the blockchain and remote internet-of-things (IoT) sensors can accurately measure groundwater usage in manner that is immediate (real-time) and transparent. The sensors are to transmit water extraction data to the orbiting satellites, after which it is brought onto the IBM blockchain platform which is hosted within the IBM Cloud. The blockchain is to record all exchanges of data or transactions made in an append-only, immutable ledger. It is also planned for smart contracts to be incorporated, so that transactions are automatically executed when the conditions are matched[4].

The Sacramento-San Joaquin River Delta encompasses 1,100 square-miles and provides water to key regional conurbations including the San Francisco Bay Area and Southern California. The natural environment of the delta also plays host to numerous varieties of legally protected aquatic, plant and animal species. The region is also a key element in the agricultural base of the fructiferous region.

The origination of the groundwater management practices lies in state legislation known as the Sustainable Groundwater Management Act (SGMA, 2014), which has mandated the creation of Groundwater Sustainability Agencies (GSAs), which in turn

[4] See also Chohan 2017d

are local community groups responsible for ensuring that regional groundwater supplies are managed in sustainable ways. The target date for achieving hydrological sustainability via the GSA intervention and management is 2040.

This blockchain-based project is likely not just to boost ecological protection, but also assist in the protection of a substantial economic sector: Californian agriculture. Drought has loomed large over this region, and its previous spell caused damage worth $3 billion. The aforementioned SGMA was passed in response to those drought conditions with a view to regulate groundwater pumping.

As part of this blockchain initiative, a web-based dashboard will be available to farmers, financers and regulators alike, which will enable real-time monitoring of groundwater use in a transparent manner. This will help foster a market-based solution by reducing information asymmetry, since individual users who require groundwater amounts in excess of their cap will be able to acquire groundwater shares from other users who do not require all of their supply at a market-regulated price. The blockchain element of this project therefore enables market mechanisms to work more efficiently by mitigating information asymmetries, and this is an important contribution of blockchain-related technologies to contemporary economics.

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