BLOCKCHAIN FOR GLOBAL DEVELOPMENT

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In the last year, global interest in blockchain technologies and their possible impact has permeated the public consciousness. Although much of this early attention has focused on the financial applications, many are eager to speculate about the ways blockchain will transform societies, institutions, and the very world as we know it. Many of these predictions inspire and galvanize observers and participants alike. However, these tools are very new and still developing, therefore few are addressing the potential and possibilities of blockchain technologies in the near future.

So what can we do with blockchain technology right now? Most of the builders of the Ethereum blockchain ecosystem at ConsenSys share a vision of a decentralized future that creates opportunity and abundance for all people. Ethereum has the unique potential, and some may believe even an obligation, to create a more accessible, equitable, and inclusive ecosystem from the outset by investing in social impact initiatives now. The developing world stands to benefit most dramatically from creative applications of decentralizing tools and economies. This essay explores possible ways Ethereum-facilitated technologies can shape global development. We focus on three core applications of blockchain-enabled solutions: peer-to-peer smart contracts, self-sovereign identity, and consumer utility tokens.

The Ethereum blockchain is a public, open-source, distributed computing platform that supports the development and utilization of decentralized applications. Whereas the Bitcoin blockchain was designed primarily as a payment system, Ethereum allows for more diverse capabilities, including its associated cryptofuel (similar to a currency), Ether, as well as smart contracts (see below). "Smart contracts" are not actually smart, nor are they necessarily contracts in a legal sense. They are just executable program objects on certain blockchains that support them, like Ethereum. A blockchain is a distributed ledger that enables tamper-proof, secure recording of transactions, collected

into "blocks" of data, between participants on a decentralized, peer-to-peer network. Transactions and blocks are validated by the parties involved and do not require a centralized authority to attest to the data or approve the value transfer, which can reduce cost and frictional delays in every interaction.

In the context of the Ethereum blockchain, decentralization is both a goal and a process, as well as an architecture. The word "decentralization" refers broadly to the dispersal of component network nodes, data, computational activities, and developers across an open-source, peer-to-peer network; blockchains are not controlled by any central infrastructure, and no one party controls the data or the network. In fact, it is nearly impossible for a minority set of actors on the network to improperly manipulate the data or the programs on a decentralized platform like Ethereum. These twinned capabilities—automation and adaptability, security and configurable transparency, peer-to-peer openness and greater individual control—all arguably make Ethereum the first technology that could facilitate widespread decentralization, and thereby help us to address systemic imbalances and bring about a more equitable distribution of information and resources. Proponents of blockchain technology aspire to enable distributed cooperation between strangers on a global scale by way of mechanisms that automate trust; the question is, how might that become a reality?

SOCIAL CONSTRUCTION OF BLOCKCHAIN TECHNOLOGY

As with all new technologies, blockchain is not a panacea, nor should it be implemented without careful consideration of the context and an evaluation of previous interventions within that context. We examine Ethereum's possible impact from the perspective of the social construction of technology, drawing from the work of sociologists and organizational theorists. When we discuss the social construction of technology, we refer to an iterative social process in which individuals and collectives use a technology, observe its intended and

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unintended consequences, and then build new technologies.

Scholars have concluded from such studies that technologies cannot guarantee a definitive impact, even when they are built with specific intentions. This matters because it offers space to inquire into how individuals, organizations, and societies interact with technologies, and with each other. In the context of global development, this means that, in order for new technologies to empower all citizens instead of perpetuating global hierarchies and historical concentrations of power, we must be vigilant about how and where they are implemented.

We are in a particularly critical moment for considering these questions. Blockchain technology is less than a decade old: Satoshi Nakamoto released the Bitcoin white paper in 2008, and Vitalik Buterin published the Ethereum white paper in 2013. The development of blockchain software protocols and applications that enable their decentralization is still very much in progress. Blockchain in 2018 is entering a critical selection phase, in which it may evolve from a fringe technology used by a small group of enthusiasts trading cryptocurrencies into a truly public and global platform. Social dynamics shape the adoption, implementation, use, and meaning of a technology during the so-called selection phase, which is the early period of ecosystem development in which ever greater numbers of users adopt a new technology.[1.] The conventions, habits, and structures that emerge during this selection period for blockchain are likely to determine its future success as a social tool for facilitating decentralization.

The social construction of a new technology often begins with enterprise projects developing and testing a tool. Gaining traction around innovation requires funding, and this dynamic can be useful in accelerating development and gathering critical resources early on, which has proven true in the first few years of Ethereum's development. However, it also means that the assumptions guiding these initial projects can solidify into assumptions about the entire ecosystem. This can be a drawback, as the problems an enterprise is trying to solve are very different from those faced by vulnerable populations, where access and inclusion usually are far from guaranteed, information asymmetry is rampant, and power dynamics are uneven, although there may be some common elements in the solutions.

The challenge of the digital divide—the differential access and ability of individuals, communities, and countries to use information and communications technologies and the socioeconomic and political inequalities that result—is particularly urgent during the selection period of a new technology. Failing to address these imbalances early on can exacerbate an already wide gap. The success of the blockchain ecosystem and being able to deliver on the promise of decentralization is as much a question of inclusion as one of effective protocol development and usability.

THE POTENTIAL OF SMART CONTRACTS

Many great minds and high-impact organizations around the globe already recognize the potential of the Ethereum blockchain and decentralization to increase access, streamline processes, and enfranchise global citizens. Much of the attention in the ecosystem's early days has focused on financial inclusion, or "banking the unbanked," which refers to the at least two billion of the world's population who do not have access to the traditional financial system. The thinking is that, with accessible, secure digital identities, lower transaction costs, and cheaper

remittances, the barrier to entry around global financial networks will be lower and more people will be able to participate.

While this could prove true in the longer term, we argue that this is the wrong emphasis in the early stages of the ecosystem. Building so-called solutions in traditional financial centers and expecting marginalized populations to embrace them wholesale oversimplifies the social process of technological adoption. Moreover, it would require significant disruption of a vast, old, and entrenched system. There are other blockchain-based solutions that can address a broader range of pressing international development issues in a local context.

These solutions must strive to avoid repeating what William Easterly has called the problem of "authoritarian paternalism," wherein the donor community—usually composed of wealthy people from so-called developed nations—decides what is best for poor or disenfranchised citizens in the "developing" world.[2.] These efforts often are based on distorted assumptions of what those vulnerable populations really need, or they focus on increasing access to institutions important in the developed world, such as banks or deeded property records, in regions that are operating outside of Western economies.

From a financial inclusion perspective, the buy-in nature of most cryptocurrency-backed blockchain applications assumes that under-resourced localities define "value" in the same way westernized communities do—via fiat currency—rather than by other quality-of-life measures like access to resources, social capital, or the direct exchange of goods. Easier access to credit or lower cross-border transaction fees are often degrees removed from the daily concerns of someone living on less than $10 per day—which is true of 80 percent of the world community.[3.]

Whereas the Bitcoin blockchain emphasizes value exchange, the Ethereum blockchain introduced the mechanism of a smart contract, which enables trusted transactions, automated trust and agreements, and software objects to be shared and used on the decentralized World Wide Web. Smart contracts are essentially code that can process information and self-execute actions based on established rules and conditions, thereby carrying out agreements automatically. In many cases, this tremendously versatile mechanism removes or reduces the need for intermediaries or third-party actions or attestations, reduces transaction time and cost, and enables the automation of a broad range of tasks on a global scale.

Blockchain technology has the potential to increase productivity, efficiency, transparency, and disintermediation in peer-to-peer value or information exchange. All of these characteristics also create challenges for legacy organizations that are carrying out global humanitarian efforts and economic development, thus the potential benefits are manifold. In order for international development to be more than merely a top-down process—which inevitably creates opportunities for the abuse of centralized power—it is crucial to involve beneficiaries in the development of the technologies designed to empower and enfranchise them.

In the current value chain of international development, funds travel across borders from a global network of donors or lenders to a system of implementation partners and local organizations. This economic circuit is opaque, inefficient, and slow, and much potential value is consumed before it reaches the intended beneficiaries. Blockchain technology is potentially a high-precision tool for understanding and instrumenting social economics. It can help the donor community track and monitor funds through the

complex aid distribution system and cut out cross-border costs and intermediary fees in the process.

A notable recent example is the World Food Programme's (WFP) Ethereum experiment in the Azraq refugee camp in Jordan. By incorporating biometric registration data from the UN High Commissioner for Refugees, more than 100,000 people in the camp have bought groceries with a retina scan that verifies their entitlement voucher.[4] The WFP records and accounts the associated payment on the blockchain, which slashes the cost of cross-border and intermediary fees to just 2 percent of their previous amounts. This streamlined system can free more funds to go straight to beneficiaries, which could eventually include all 500,000 Syrian refugees currently living in Jordanian camps.

Creative application of immutable ledgers and smart contract mechanisms has the potential to solve such issues as local corruption—for example, in the Niger River Delta, where funds intended for cleaning up severe oil spills are rerouted by militants and local government officials—or to create networks of multiparty transparency in nonfinancial peer-to-peer value exchanges. Constructing blockchain architectures that build a micro-economy of services that is mutually tethered to incentives (and disincentives) is a more effective and sustainable means of empowering impoverished communities.

A common claim about the potential of blockchain to facilitate decentralization is that influence can potentially move from the center—governments, large hierarchical organizations and companies—to the edges. In international development, this could manifest as two-way accountability in aid distribution and the genuine empowerment of vulnerable communities.

Upward accountability exists in the form of reporting on funds and assistance; recipients of aid are accountable to the groups that provide it. For example, if a local NGO receives funding from USAID, it is required to report on how the funds are used and to demonstrate their impact. Blockchain technology can benefit both parties by enabling more transparent tracking of funds and their effective deployment on the ground.

Downward accountability, or funders' and NGOs' accountability to the populations they are working to serve, has been more difficult to implement. It is not easy to gauge reliably how effectively a group's efforts are meeting the needs of local populations and integrating them into new iterations of their solutions. With simplereporting or surveying on a decentralized application, perhaps on a readily available mobile phone, the work of collecting trustworthy feedback could happen on the ground without requiring field staff to facilitate it, thereby avoiding potential corrupted or fabricated reporting.

A recent example is the distribution of funds to educate Syrian children, 1.6 million of whom have been displaced since 2011.[5] The countries hosting the largest number of school-aged Syrians—Turkey, Lebanon, and Jordan—have received more than $1.4 billion in aid funds to support their education, yet at least half a million children have not received any education, due in part to local policies that exacerbate poverty and increase social pressure to choose work or marriage over education. Better reporting on the distribution of funds, more supportive policies for refugee families, and better coordination between aid organizations would vastly improve the situation for Syrian children. Incorporating blockchain technology could begin to make this possible.

THE POSSIBILITY OF SELF-SOVEREIGN IDENTITY

Although financial solutions are a readily available advantage of Ethereum blockchain applications, the nature of a decentralized database and immutable ledger offers still greater benefits in enfranchising individual citizens. Another application central to the vision of blockchain technology and the possibility of a decentralized world is the proliferation of self-sovereign identity. The term "self-sovereign" has recently entered the lexicon to describe some identity systems, usually blockchain-based. It does not connote a personal bubble of idiosyncratic laws, though perhaps in time the world may move to more granular sovereignty. Rather it represents what many believe is the right that all individuals on the planet should have to own and control their own personally identifying data. A self-sovereign identity is a persistent, portable digital identity that is under the control of the owner, with various aspects encrypted and selectively disclosable by the owner in situations she designates. "Official" identities currently are managed by the state; relevant data is stored, and in effect controlled by, a government body. Individuals in unstable or hostile states thus risk losing their identity if they cross borders, flee their homeland, or lose their ability to access funds or set up new accounts. (Less formal, but equally important, aspects of many of our identities are controlled by corporations that store and monetize this personal information, often without adequately securing its storage.)

The International Labor Organization estimates that at least 21 million people are affected by human trafficking, most commonly in the form of sex slavery or forced labor.[6] More than 26 percent of those people are children. Having a self-sovereign identity could make it possible for individuals caught in human trafficking to flee without depending on a passport or other form of identification that otherwise could be withheld or stolen from them.

However, no technology has inherent social power, only potential social utility. A new technology acquires meaning from the ways people use and adopt it; thus, to become a solution, an adopted technology needs to be coupled with informed and proactive policy. For example, introducing self-sovereign identity on the blockchain to a vulnerable population living under a corrupt government does not suddenly solve the problem of human trafficking. In fact, in such cases technology can become a weapon to use *against* the very people it is intended to help.

A current example is the problem of sex trafficking in Moldova, a country known for a high level of kidnappings and forced labor, particularly in the breakaway region of Transnistria.[7] Depressed economic conditions and a lack of local opportunity—the average monthly salary is just $230—force many Moldovans, including many women and children as young as 13, to migrate elsewhere, often in response to fake online job postings. People from rural areas are at a particularly high risk for kidnapping because they often do not have state-issued identification, which makes it easier for traffickers to move them across borders using fake documents, rendering them all but invisible to border authorities when they go missing.

While a self-sovereign, immutable digital identity for Moldovans might seem like a workable fix, well-established criminal networks that cooperate with corrupt officials will likely find a way around enforcement steps, like checkpoint verification. In an already unstable political environment, workarounds, bribes, and further abuses of power could easily undermine a more secure identity system and place vulnerable Moldovan citizens in greater danger. Technology alone is not a life raft; to uphold solutions it requires buy-in and participation from government and non-government organizations alike, as well as the implementation of supportive policy. Self-sovereign identity is a potentially powerful tool for vulnerable populations across the

world, but the social structures surrounding identity must be in place for that potential to be realized.

THE PROMISE OF CONSUMER UTILITY TOKENS AND WORK-IN ECONOMIES

Another blockchain-enabled solution could give local social networks greater agency and incentive feedback loops, thereby empowering marginalized communities to develop their own tools for change. A token is a digital asset that either has its own inherent value or represents some other asset on the blockchain. Using a crypto-economic incentive mechanism, tokens can promote the emergence of new, distributed digital networks of mutually incentivized participants and help them coordinate their efforts to achieve a common goal. Consumer utility tokens are often services or units of service that can be used to gain access to services provided via a decentralized application (i.e., a digital subscription or membership sold in exchange for access and reduced fees). Utility tokens can also serve as claims on content, like a song, or scarce resources, like decentralized data storage, for instance. Consumer utility tokens are distinguished from investor tokens, in that securities bodies around the world would not consider them to be subject to the strictures of securities law.

Consumer utility tokens on the blockchain can provide a mechanism for economically incentivizing social good. With the ability to create "programmable" economic incentives, a development target or milestone can be built into the feedback loop of the token as a functional component of its design. A token can reestablish economic incentives that enhance quality of life for the members of its user network. The token is a means of "keeping score" between the services being exchanged, wherein a voting system lets users rate one another's work. This could be as simple as letting community members vote on which tasks or services are most in demand in their local network.[8.]

Other token-related tools, such as token-curated registries (TCRs), can also facilitate peer-to-peer management of mechanisms for mutually improving quality of life and local economic conditions. A TCR is a system in which users apply to a list vetted by a group of token-holders that upholds a set of criteria. The list is designed to incentivize its own maintenance by its curators so that it continues to evolve in a valuable way. A TCR could include a list of services needed in a particular social group or microeconomy, or a ranking of services performed or exchanged. Management and implementation are in the hands of the participants, and the potentially quick feedback loops can boost a microeconomy or effect social change much more swiftly than any existing top-down methods.

Given the challenges of downward accountability and transparency across global development efforts, tokens are a potentially powerful way to include beneficiaries in aid programming efforts, or even to empower them to control new means of coordination among themselves.

LOOKING AHEAD

The tools described in brief in this essay—smart contracts, self-sovereign identification, utility tokens, and TCRs—are available now. While it may take years to understand the impact of the Ethereum blockchain across institutions, the possibility for broader social change begins with the solutions developed during the selection phase.

Whether we will succeed in building a decentralized future together depends

on early efforts to make Ethereum-supported technologies accessible, inclusive, and tailored to local social contexts. Observers and participants alike should hold one another accountable to these goals in a spirit of productive coordination and shared responsibility. In global development, as in many other fields, the potentially transformative power of these tools is great, but only if they are constructed to function in the world as it is now, in all its entrenched and challenging complexity, as well as to facilitate the transition to a more equitable world.

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