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Economic Analysis

Blockchain: The Road to Utopia

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- **Non-financial blockchain applications are growing exponentially**
- **Transaction costs will decline considerably, thereby impacting the role of intermediaries**
- **The blockchain is expected to set the basis for better economic, social and political systems**

Blockchain, also known as Distributed Ledger Technology (DLT), is a general purpose technology that promises to boost economic and social well-being by significantly lowering transaction costs. This is done by allowing a decentralized network of computers to use consensus algorithms and cryptography to validate transactions and record them in a chronological order, thereby creating a distributed and immutable chain or ledger.

Currently, the validation of transactions is conducted by intermediaries such as financial institutions, governments, lawyers and accountants. But in the blockchain, economic agents are allowed to "regularly find consensus on the true state of the shared information."[1] This form of validation eliminates the need of intermediaries. The DLT can be identifiable or anonymous, public or private, and it can contain transactions such as the exchange of money, goods and services, while adding data attributes like identity, credentials, intellectual property, digital or property rights.

Like the Internet in its beginnings, the future of blockchain is hard to predict, and while most of the attention has centered around the impact on finance, applications to other sectors are growing exponentially. This suggests that rather than being a disruptive technology that threatens the viability of incumbents in certain industries, the blockchain is a "foundational" [2] technology that has become the basis for much deeper changes in the way society organizes economic and political activities. In the following paragraphs, we provide some examples of non-financial applications of blockchain and the companies and organizations behind them. We conclude with an assessment of the future direction of blockchain technologies.

1: Christian Catalini and Joshua S. Gans, "Some Simple Economics of the Blockchain," *MIT Sloan Research Paper,* no. 5191-16 (2017): 8
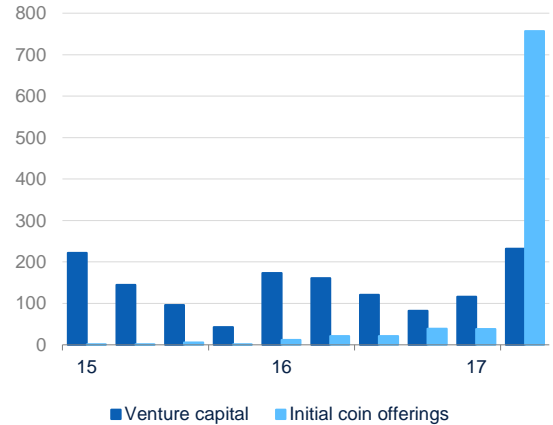2: Marco Iansiti and Karim R. Lakhani, "The Truth About Blockchain", *Harvard Business Review,* January-February 2017, https://hbr.org/2017/01/the-truth-about-blockchain

Figure 1. Blockchain Global Financing

Legend: $M, Deals (rhs)
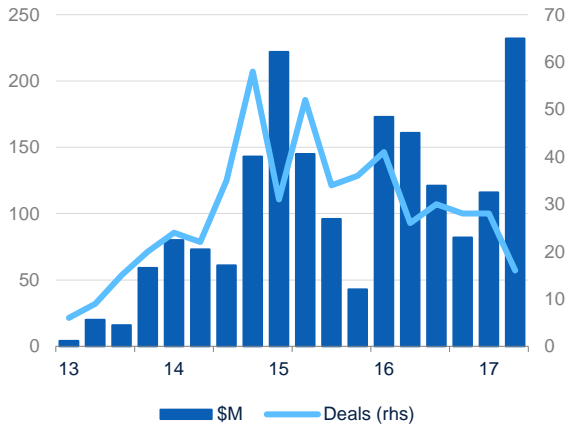
Source: BBVA Research and CB Insights

Figure 2. Blockchain Global Financing ($M)

Legend: Venture capital, Initial coin offerings

Source: BBVA Research and CB Insights

A new level of privacy, security and convenience

One could imagine that in the not too distant future, when a human being is born, the blockchain would record the event, capture human identifiers and assign certain attributes. Storing these records in an immutable ledger can eliminate identity theft, protect privacy and create a highly efficient and trustworthy mechanism to share vital information. Some records could be public while others could be private, but the benefits apply to both. Among the companies devoted to develop identification tools using blockchain, UniquID Wallet provides secure fingerprint and biometric identity management on personal devices. The blockchain would continue recording all relevant events throughout the life of the individual, who will have full control of the information. The set of information could include school and medical records, working history, tax returns, civil contracts and ownership of assets.

Universities would have direct access to school records once the candidate applies for admission. Companies like Appii use DLT to store and verify education records, accreditations, awards and employment history. Others like Chronobank are trying to use the blockchain to improve recruitment for on-demand jobs, helping individuals to find work quickly and effectively. In the healthcare space, individuals could have full ownership and control of their medical records, and decide when and with whom to share them with. During a visit to the doctor or the hospital, patients could grant temporary access to their medical information. Currently, start-ups like Gem and Tierion focus on using a blockchain network to create a secure, universal data-sharing infrastructure in the healthcare industry.

The concentration of personal information in the blockchain facilitates transactions and improves the effectiveness of service providers. For instance, insurance premiums could be adjusted immediately after driving records are added to the ledger. Project Oaken is looking at options for vehicle's sensors to collect driving data and store it in the blockchain.

Vehicle owners could see lower or higher insurance costs depending on driving habits. With more data availability and transparency, overall premiums would decline, all else equal.

Blockchain technology is expected to facilitate the adoption of unique personal identifiers that would replace the multiple account numbers and passwords that we use today across a myriad of cumbersome and unsafe databases. All the identification codes and passwords that grant access to government services, financial accounts, mobile telephones, utility services, travel documents, corporate reward programs, etc., could be replaced by a single and fully-portable token with various degrees of access that determine how much personal information can be shared. This could help to better enforce international agreements on issues like double taxation, migration, retirement benefits, and labor mobility, among other benefits. Currently, companies like Identifi link all personal profiles and identifiers to create a trustworthy identity.

More efficient markets

In a world where Blockchain displays its full potential, individuals could work around utility companies to trade energy under a peer-to-peer model. This could enhance the resilience of energy provision, which is particularly vital at times of high demand or in cases of emergency. Moreover, it could reduce costs and promote clean energy sources. LO3 Energy is developing microgrids in Brooklyn, NY, to enable local energy trading, while Power Ledger is trying to allow "prosumers" to sell excess energy production from solar rooftops to the grid operator at a much lower costs, which could greatly benefit small businesses.

By linking the blockchain to the physical world, individuals could safely record purchases and sales of big-ticket items like houses and cars, luxury goods like fine art and jewelry, and intellectual property like patents and music. OpenBazaar develops decentralized blockchain utilities to connect buyers and sellers, acting as an open-source, peer-to-peer network with no fees and no restrictions on what can be sold.
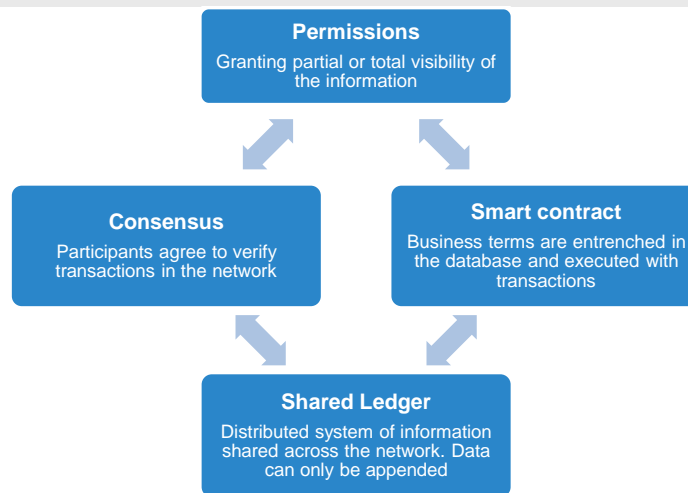
In a fully blockchain environment, individuals would be able to exchange properties seamlessly without going through the thorny process of dealing with intermediators such as realtors and title companies. In fact, UBITQUITY uses its SaaS blockchain platform to allow users to securely record, track, and transfer deeds in a simple fashion that reduces title search time and increases both confidence and transparency. When purchasing a car and determining its price, the ledger would include important information on repairs, maintenance and accidents. For example, DocuSign is developing a "click, sign, and drive" process to allow drivers to lease cars. The transaction is registered on the blockchain and includes the option to buy insurance from the driver's seat.

Innovators, writers, composers and other artists would be able to register patents or artistic work before seeking publication or releasing it to the public in order to avoid plagiarism and other copyright infringements. For example, Ascribe allows individuals to create a permanent and unbreakable record of ownership between the person and the

creative work that can be forever verified and tracked. Likewise, Bittunes developed a peer-to-peer platform to allow music makers to automatically receive royalties whenever and wherever a music sale takes place.

The combination of the Internet of Things (IoT) and smart contracts would allow any device to connect, interact, and transact independent of a central authority. Companies like Filament offer low-power hardware nodes that connect existing machinery and industrial infrastructure to the network. This allows a decentralized network for IoT sensors to communicate with each other, allowing companies to track inventories, machinery or hazardous materials.

Figurer 3. Basic Structure of Blockchain Applications for Businesses

Permissions
Granting partial or total visibility of the information

Consensus
Participants agree to verify transactions in the network

Smart contract
Business terms are entrenched in the database and executed with transactions

Shared Ledger
Distributed system of information shared across the network. Data can only be appended

Source: BBVA Research

The power of blockchain and IoT could allow individuals to temporarily rent goods and services. After paying for the service, a token could allow temporary use of cars or apartments. Once the token expires, the good or service would no longer be available for use. This transformation would maximize the potential of the sharing economy, eliminating some of the sharing platforms that have grown exponentially in recent years. In fact Arcade City began with the idea that a ride share company should be run by its drivers, or in other words, a network built by local communities.

Blockchain, institutions and democracy

From a government perspective, some institutions may become obsolete, but others may turn more efficient. The blockchain could lead to the elimination of bureaucracies. As soon as paychecks and other monetary transactions are registered, tax payments and retirement and welfare benefits could be calculated for immediate or future process. This would eliminate tax evasion and burdensome administrative processes, which would render some functions of the tax authorities and certain public administrators irrelevant, as contributions and benefits would flow as soon as certain triggers are activated. For example, Factom offers database management and data analytics to support various applications that

businesses and governments can use. With a permanent, time-stamped record of data, firms can reduce the cost and complexity of conducting audits, managing records, and complying with government regulations. Meanwhile, the Delaware Blockchain Initiative is trying to create a legal framework to increase the efficiency and speed of incorporation services.

To date, at least nine states: New York, Arizona, California, Delaware, Maine, Vermont, Illinois, Hawaii and Nevada have introduced, and in several cases passed, legislation related to the validity of records and transactions in the blockchain. In less developed countries, individuals would be able to register ownership with legal certainty as governments would not be able to alter records and take away the property of its citizens. In fact, countries like the Republic of Georgia and Honduras are trying to build blockchain-based land-titling services. This represents a unique opportunity to develop and strengthen property rights, which are critical for economic development. Some estimates suggest that the value of assets worldwide in which people do not have legal ownership could be around $20 trillion.

In other cases, law-enforcement institutions could have access to the ledger in order to combat crimes such as money laundering, terrorism, human trafficking or fraud. The ledger can be used to assure that evidence remains tamper-proof or to flag certain suspicious transactions. For example, Elliptic uses a proprietary database that links Bitcoin addresses to clear and dark web entities, and then delivers evidence to law enforcement agencies in cases involving illegal activities.

Blockchain can also serve as an effective tool to protect consumer rights. One promising example is using the blockchain to monitor clinical trials through greater transparency, better structuring and checkable methodologies. This would enhance the integrity of pharmaceutical products while boosting the efficiency of the cumbersome process from the lab to the pharmacy. In fact, in 2016, the Chinese State Food and Drug Administration revealed that more than 80% of the data used in clinical trials of new pharmaceutical drugs have been "fabricated". Companies like Provenance, aims to create transparent supply chains for all types of products. In the food industry, for example, the use of blockchain to track and validate supply chains could enhance the speed and efficiency of dealing with contaminated food. For more conscious customers, knowing where certain products come from and how they were produced could determine if they end up purchasing them or not. This could take organic and sustainable food to a greater level from what we have seen so far. Blockchain technology can also be used to protect human rights. For example, The Guardian Project has developed a system to safeguard the work of activists, journalists, and humanitarian organizations, while Everledger uses blockchain to monitor diamonds from sources that use forced labor, recording the jewel's ownership from mine to ring.

Democracies could be improved if individuals are able to vote on the blockchain, creating a reliable and unbreakable system to verify if votes are correctly recorded and counted. In such a system fraud would be eliminated. Already, Follow My Vote -with elliptic curve cryptography- and Votem are developing offers for online safe and transparent voting solutions to ensure reliable and legal elections. For many developing countries this would be an opportunity to implement stronger democratic systems, reducing the impact of corruption and institutional fragility.

Meanwhile, policymakers could have access to near-infinite data to better design and forecast policies. For example, certain subsidies or tax incentives could be valid only under certain conditions, much in the way that exists today. However, as information flows on the blockchain, the subsidies or tax credits would adjust to guarantee that the net benefit to society always remains positive. Since the formula depends on data collected by the blockchain, it would be impossible to maintain policies that are no longer needed or too expensive. In fact, some countries like the U.K. and Finland have announced trials to analyze and distribute welfare benefits using blockchain as a way to improve distribution and reduce both inefficiencies and fraud. For example, recipients of what can be seen as the next-generation food stamps would be limited on products and merchants when spending these benefits.

Blockchain could also improve transparency on the operations of nonprofits, allowing donors to accurately assess the effectiveness of their contributions. This would encourage organizations to improve governance and operational efficiency in order to compete for donations. For example, the GiveTrack project allows nonprofits to provide transparency and accountability to donors by sharing financial information and direct project results in real time.

How far are we from the ideal world?

Because of its multiple applications and transformational nature, a fully adoption of blockchain could take many years. Despite its vast potential, it is still difficult to envision a world where every agreement, process, task, and payment would be digitally recorded, identified, validated, stored, and shared. The first obstacle is scalability and implementation costs. While in traditional databases the solution to operate more transactions is to add servers or computing power, in a DLT every node needs to process and validate every transaction. However, since the system is decentralized, it is hard to add computing power to every node in the network. Likewise, as the network grows so the energy consumption to keep it operating, to a point where the required amount of electricity needed to run a massive DLT becomes economically unfeasible relative to the current system.

Another obstacle derives from political and economic motivations that often delay and distort the development and adoption of new technologies, in part because incentives are geared towards maximizing short-run gains rather than investing for the future. Often, innovations that started with a particular objective ended up transitioning into something quite different. Some would argue that this is exactly what happened with the Internet and that instead of having one or few fully decentralized ledgers; we could end up with a few private DLT controlled by the same companies and public institutions that are currently facing disruption.

However, regardless of how blockchain evolves and how much time it will take for massive adoption, it is clear that most limitations can be solved by the emergence of complementary technologies, as it has happened with the Internet. In any case, the potential benefits of blockchain are so vast that even a system that ends up resting between full realization and what we have now should be seen as a positive outcome, sufficient enough to keep the DLT dream alive.

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