Blockchain: Status-Quo, Enablers and Inhibitors

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Abstract — **Blockchain has been evolving and gaining new heights over the years. The shift in the perspective is allowing new user cases beyond the cryptocurrency space. Cryptocurrencies are digital assets supported by the complexities of cryptography, game theory and peer-to-peer networks. Blockchain became a popular platform for decentralized applications, as well as a valuable tool for start-ups seeking fundraising. The aim of this research paper is to review and assess the status quo for each branch of use cases, and then analyze the enabling and inhibiting factors influencing the adoption of blockchain. These findings permit a broader comprehension over the concepts backing blockchain. It will help new users to establish strategies, develop solutions and encourage the employment of blockchain technology.**

Keywords—blockchain, cryptocurrencies, Dapps, blockchain business models.

I. INTRODUCTION

Several projects took place aiming to deliver electronic payments overall the past 30 years. Ecash (DigiCash) in 1992, e-Gold in 1996, e-Bullion in 2001, just to mention a few [1], [2] [3]. Most projects failed due to legal compliance or mismanagement matters [4]. The concept of block chaining, or chained blocks have been used for decades in cryptology. Initially in the context of network security, message verification, authentication and data integrity. Block chaining was a cryptographic construct aimed to improve efficiency, reliability of time stamping and content delivery by linking hash values of a digital document [5] [6].

The concept of decentralized digital currency was explored in 1998 by Nick Szabo on the development of BitGold [7]. Bitcoin was the first cryptocurrency use case to make use of block chain technology. Under the fictious name of Satoshi Nakamoto, it was released the first implementation of peer-to-peer (P2P) trustless electronic cash [8]. Nakamoto's goal was to eliminate the middleman, and traditional financial institutions such as banks, credit cards or money transfer companies. Key differences between bitcoin and its predecessors are the (a) deployment of the P2P network, (b) absence of a central server to prevent double spending and timestamping functionalities, (c) tokenization and rewarding mechanisms to enable nodes to execute vital activities to the system, (d) ledger that records the state and history of all transactions, (e) cryptographic resources that builds up the trust environment via the chain of blocks and (f) the consensus protocol that links all the building blocks together allowing peers to safely perform transactions in an untrusted environment.

Consensus protocol is the engine that sanctions all the pieces together in blockchain. The key underlying building blocks, such as cryptography, hashing function, peer to peer communication, game theory, decentralization, are all reflected in the consensus protocol. It defines the speed,
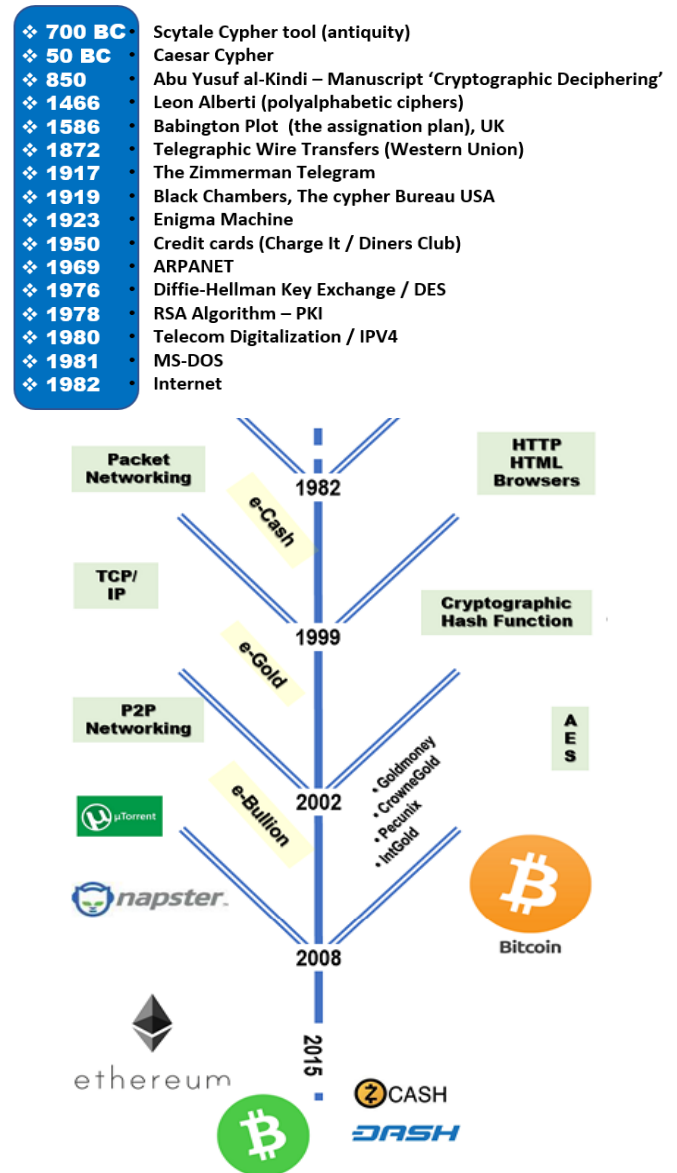

Figure 1: Technology evolution until blockchain

security, costs, ownership, etc. Authority is proven by digital signatures which is a combination of public and private keys. Tokens represent the assets owned by the identities (users) that own these digital keys. Transactions are signed and registered forming a block which is cryptographically protected. Every node participant agrees on the state and history of the token transactions. In section II, it will be examined blockchain use cases and section III the key enablers and inhibitors that affects its deployment.

II. BLOCKCHAIN USE CASES

This research identified three business segments under the blockchain domain: (a) cryptocurrency, (b) utility platform for decentralized applications and (c) business model for capital raising. Although there is some overlap and interdependency, these segments are distinct and quantifiable. These opportunities are explored in more details in this section.

A. Blockchain as a cryptocurrency

Money has been evolving since pre-history. From shells, beads, bones, colored feathers and pebbles, to the bartering system. Shekel is mentioned in cuneiform texts in Mesopotamia 3,000 B.C. First as a unit of measurement, and then, in 600 BC shekel coins were introduced [9] [10]. Later, silver besides being a commodity, also functioned as money. In the late 17th century paper money was introduced in Europe. Credit cards came up in the mid of 20th century and soon became the number 1 choice of payments. More recently, cryptocurrency has been introduced. The motivational aspects of crypto-coins can be linked to groups with technological-political orientation and also to socio-economic factors [11], [12], [13], [14], [15], [16].

The cryptocurrency market can be segmented in several ways. The first wave of cryptocurrencies, until 2013, mainly focused in the storage and transfer of values. When the numbers of users grew exponentially, the technology presented several limitations such as throughput, scalability, transactions costs, environment sustainability, security, etc. In Q3 2018, there are over a thousand cryptocurrencies being listed in the main digital exchanges [17] [18]. Most coins have differences in their business proposition, focusing in specific attributes such as privacy, security, transaction speed and so on. Many coin projects have been abandoned, due to scams and lack of development support [19] [20]. As depicted in **Table 1,** the current trend is still high with a market cap of 302 Billion USD.

Bitcoin accounts for 47% of the total volume market cap (142 Billion USD Q3 2018). There are other 19 coins with market cap between 1 and 99 Billion USD. Ethereum is the leader on this category with market cap of 48 Billion USD [18]. The potential to growth of the cryptocurrency business is still high, but not necessarily as an alternative to fiat money as originally conceived. The currency fluctuation is still very high, making it impractical for financial planning purposes. Nevertheless, new use cases making use of the tokenized economy have been emerging daily. It is opening new opportunities and creating a more sustainable environment as the technology grows stronger when associated to business trends outside the blockchain space.

Table 2 - Cryptocurrency Market Cap Range Q3_2018

Market Cap Range	Number of Cryptocoins	Total Volume $USD	Most popular coins per range (Not a complete list)
• > 100B	1	$142,739,524,121	Bitcoin
•1B to 100B	19	$126,588,274,320	Ethereum, EOS, Ripple, NEO, Litecoin, Dash, Cardano, Monero, Litecoin, Ethereum Classic, IOTA, etc.
•100M to 999M	74	$19,886,992,275	Zcash, DogeCoin, Qtum, Ox, Nano, etc.
•10M to 99M	355	$10,812,275,660	n/a
•1 to 9.99M	476	$1,913,238,646	n/a
•< 1M	467	$145,875,537	n/a
TOTAL	1392	$302,086,180,559	n/a

B = Billions USD   M = Millions USD

Comparison	APPS	DAPPS
Governance	- Central Management - Private code	- Managed by consensus Protocol *(No Central Management)* - Self executing Smart Contract - Code is open source
Fees	No	-Subject to fees in the current stage -Newer platforms promising no fees*
Censorship Resistance	No	Yes, more resistant
Ability to store value	No	Yes
Availability	- Can be discontinued by governance or fault	Greater availability. No single point of failure
Network Security	-High -It can be an easy target to DoS attack	-High, no single point of attack -Still subject to security issues outside the blockchain scope
Throughput / Speed	Very High	- Low in the current stage - Newer platforms promising high speed and throughput*

* New Blockchain Platforms in the horizon: EOS, NEO, TEZOS, CARDANO, WAVES

Table 1 - Comparison APPS Vs DAPPS

B. Blockchain as a Software Utility Platform for Deliverying Decentralised Applications (Dapps)

Decentralized applications (Dapps) is a by-product out of blockchain technology. The underlying concept is the utilisation of the blockchain network as a platform to the deployment of self-governing applications. Dapps can be categorised by use cases, industries, or type of services [21][22]. Earlier Dapps only stored cryptocurrencies for direct P2P payments. Some Dapps mix money with external information (outside the blockchain network) through an interface referred to as 'oracles'. There are Dapps that only explore the trusting attribute of blockchain and are unrelated to money. E.g. as a voting or a governance system. Many use cases can benefit from blockchain or similar technologies such as the Distributed Ledger Technologies - DLT. The key difference between blockchain and DLT is in the accessibility and authentication. Blockchain operates in a permissionless and open environment while DLT, in most cases, operates in a permitted (closed) environment. Regardless if blockchain or DLT, rules and policies are created by design, on a case by case basis. Most Dapps use cases are associated to the issuance of new tokens or smart contracts.

The tokenization property of blockchain enables Dapps to become a utility platform, a tool set that can be scaled and applied to any phenomena involving transactions. This concept transcends the space of mobile and desktop applications. Dapps have been tried out in many fields, from P2P energy transaction to food certification, from data provenance to government, just to mention a few.

Developers can create private cryptocurrencies and contract-based applications using a Turing-complete (or equivalent) language, which allows businesses to set their own rules and policies**.** It allows cost savings during the building and implementation stage and to maintain a business and operational infrastructure at lower fees. While traditional methods require payment processing (e.g. PayPal, Visa, etc.), registration, complex database, server, Dapps allow transaction processing automatically on a decentralized architecture, faster and less costly. Ethereum is largely the most used platform for Dapps deployment. Game is the leading market niche for Dapps (Fig. 2).
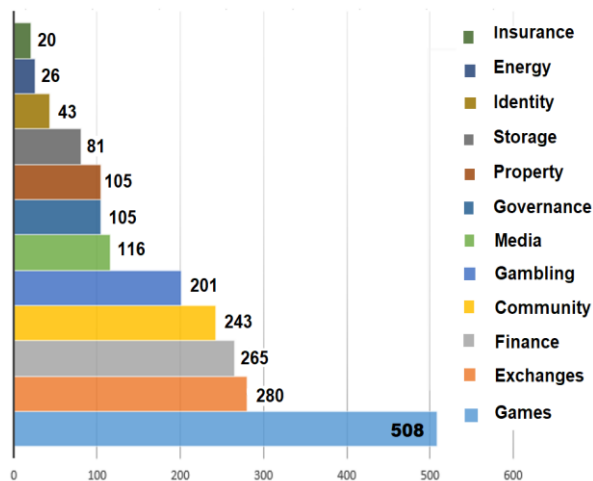
Figure 2 : Dapps market breakdown

Smart Contracts are a piece of software enabled by blockchain (or DLT) that is embedded in the application. It is intended to automate and enforce contract arrangements or tasks between network participants without a third-party intervention. It can be contractual clauses triggered by any event which are coded and linked to the blockchain network. They can be self-executable, self-enforceable, generating automatic payments, billing, invoices, sending messages, keeping track of a chain of events as a way for reducing costs.

C. *Blockchain as Business Model for Capital Raising*

Traditionally when a startup or a stablished business wanted to raise funds, they would have to undergo the tough mission of pitching to venture capitalist, banks, angel investors, etc. It could easily involve hundred of pitches, substantial amount of time and money and the creation a formal business plan. When finally approved, contract terms allowed little room to negotiation, slight flexibility, and usually highly onerous terms.

Crowdfunding is a method of raising finance by reaching many people or organizations to acquire equities (or rewards) for a small amount of money. It uses Internet to find thousands, if not millions of potential funders [23]. The concept of crowdfunding has been growing enormously since 2010 and shaping innovation in services, products, projects, investments, causes and experiences causing a shift in the role of financial institutions. As crowdfunding became a popular investment form, over a thousand crowdfunding platforms have emerged worldwide [24]. Blockchain allowed the introduction of tokens in substitution of equity shares in crowdfunding. That increased the access to a larger audience since anyone with access to Internet, an online bank account and a crypto wallet account could participate of the crowdfunding.

Depending on the business strategies, the solution may adopt an existing cryptocurrency platform to launch the business. That would facilitate and speed up the funding event and development of the product/service faster. In some cases, the solution may involve the creation of a new cryptocurrency. The Initial Coin Offerings (ICOs) are the most common choice for financing startup business in the blockchain space. An amount of cryptocurrency tokens can

be negotiated with the investor in advance, instead of shares. The basic assumption is that the business will grow, and the coins will be traded in the future with an expected profit to the investor. Any services or goods produced by an organization can, in theory, be traded in cryptocurrency for future payments. It is estimated that over 6 billion USD was raised from ICOs in 2017 [25]. According to the report from PwC Strategy and Analyses, ICOs have grown dramatically during the first 5 months of 2018, raising U$13.7 billion. This amount accounts for more than all the ICOs combined since 2013. Table 3 depicts the countries with most traction for ICOs. The USA, Switzerland and Singapore are the hot spots for ICOs, followed by the UK and Hong Kong [26].

Legislation varies in each country so risks and compliance. The speed at which ICOs have grown brought challenges to regulators. In some countries ICOs are not even permitted. While equity crowdfunding is regulated, ICOs are unregulated and consequently risks are greater. There are other frameworks being adopted by startups in different jurisdictions. The Simple Agreement for Future Tokens (SAFT) is a form of investment contract that may be suitable in those countries (or states) where a crypto venture investment is considered a security. The SAFT agreement refers to the funds received by the entrepreneur in exchange of documentation establishing that should a product or service be created and available in the future, the investor will be given preference. So, in principal SAFT is not a debt financial instrument as there is a pre-condition involved in case the venture fails.

Initial Loan Procurement (ILP) is another option where the entrepreneur receives funds from the creditor (investor) in the form of a loan. A document is prepared indicating both creditor and borrower details on a smart contract referring to the amount of crypto money tied up to the loan will be paid in the future. ICOs, SAFT and ILP are blockchain business models to be considered by a company seeking to raise funds. Business strategies and due diligence to comply with all relevant laws and regulations are determinant factors to the success or failure of the venture.

Table 3 - ICO Traction per Country - Comparison 2017 & 2018
Source: PWC Strategies & Analyses

Leading ICO Countries in 2018			
Country	Raised USD mn	Closed ICO	Planned ICOs
Cayman Islands	4,254	10	16
British Virgin Islands	2,227	16	2
Singapore	1,192	53	52
USA	1,092	56	50
UK	507	48	51
Switzerland	456	28	36
Estonia	323	31	40
Lithuania	259	6	5
Israel	226	5	5
Hong Kong	223	20	15

Leading ICO Countries in 2017			
Country	Raised USD mn	Closed ICO	'Unclosed' ICOs
USA	1,722	87	40
Switzerland	1,462	33	1
Singapore	641	35	13
Russia	438	57	43
China	306	14	2
UK	275	26	23
Japan	195	6	6
Canada	163	10	5
Cayman Islands	162	3	0
USA	1,722	87	40

III. ENABLERS AND INHIBITORS

In this section, most relevant enablers and inhibitors for the blockchain technology are listed. This information has been obtained based on the current market trends, news, Internet articles, white papers and a diversified range of collected opinions.

ENABLERS

There is a myriad of possibilities corroborating to the implement blockchain. Here are the most relevant aspects:

- **CRYPTOCOINS ARE A NATURAL EVOLUTION OF MONEY**
  Money has always been evolving since ancient time. From the bartering system to tally sticks, then shekels of barleys and then metallic coins. Money was introduced as a solution to facilitate trades among the first civilizations. It took hundreds of years for paper money to be accepted. Another 50 years for merchants to accept credit cards worldwide. Until 1971 the US dollar was backed by gold, not anymore. All other countries followed suit. Since then the trust in commodity was replaced by some form of virtual trust in the government. Money became a piece of paper that is only backed by the government who issued it. If the US government fails, the whole international monetary system automatically collapses. No backups. The US dollar was not designed to become a cross state currency. That is why cryptocurrency is an evolution out of the fiat money, as it does not rely in governments.

- **BLOCKCHAIN FACILITATES THE SHARING ECONOMY**
  Consumers are gradually becoming more sensitive to environment and sustainability aspects. The possibility of sharing and trading on peer to peer basis without a third party empowers local economy. It can be a game change. From sharing a car, a bike, or trading energy – any product or service that can be traded, as long as there's a demand, blockchain can facilitate matters. There are a number of platforms making use of this niche, such as Lyft Driver, ShareRing, etc.

- **BLOCKCHAIN HELPS STARTUPS TO ENTER THE MARKET FASTER**
  Blockchain offers a new framework for startups seeking to enter the market faster. ICO, SAFT and ILP are much faster option when comes to raise funds via equity investors and venture capitalists. It saves time, escapes formalities such as the expensive and time-consuming business plans and road shows pitching. Timing is paramount for tech start-ups and business ideas can be wasted due to bureaucracy and paperwork. Competition is fierce. Blockchain enables both a business model and a utility platform to launch Dapps faster and less costly.

- **BLOCKCHAIN CAN STIMULATE BUSINESS IN THE DEVELOPING COUNTRIES**
  The Internet brought many benefits to the developed world but brought no contribution to the underdeveloped world. Technological giants are all concentrated in a very few countries and the digital divide has not contracted. The decentralized nature of blockchain can help to reconfigure business and help society in many ways. It enables more transparency in voting system, public capital expenditure, helping the society to build trust faster. The World Economic Forum (WEF) considers blockchain to be among six computing 'mega-trends' that are likely to shape the world in the next decade [27]. Blockchain will allow individuals in different continents to conduct business without traditional banking and government bureaucracy. It will facilitate interactions, creating a strong bond between individuals and investors.

- **MINING HAS BEEN AN IMPORTANT DRIVER TO THE NANOTECHNOLOGY TECHNOLOGY**
  The cryptocurrency miners play a key role in blockchain networks that operates under the Prove-of-Work (PoW) protocol. Building and chaining the blocks cryptographically is very computer intensive. Over the last five years, digital mining hardware changed at least three times. From computer processing unit (CPU) to graphical computing unit (GPU), then to field programmable gate array (FPGA) and more recently to application specific integrated circuit (ASIC) technology. Several companies are all trying to create 7nm chips in mass production. It will most likely be an important game changer to the mining industry as well to the entire computer industry [28]. The 7nm chip will bring more efficiency to energy savings and allow over 20 billion transistors per square centimetre.

- **DAPPS HELPS TO LOWER INITIAL COSTS AND MAINTENANCE EXPENSES**
  Open source software leads to cost savings during the building, implementation, and operational stages. Traditional methods require payment processing, need of registration, credentials verification, database, server, Dapps allow transaction processing automatically on a decentralized architecture, faster and less costly.

- **ABSENCE OF REGULATION FAVORS BLOCKCHAIN DEVELOPMENT**
  Blockchain is not mature, and history shows that predictions for technologies do no help. The Internet went through the same learning curve in the 80's. In the 90s, the Internet was no comprehended by most of the population. Adult industry and gambling were a threat by many. No specific legislation, and intellectual property concerns [29]. E-mail was slowly introduced. Today bills can be paid, documents can be signed and sent electronically along with pictures and sound. No one could predict the success or failure of Internet - until it gradually became a reality. Any attempts of regulation before the technology is understood can be detrimental to its development.

- **BLOCKCHAIN HELPS & CUSTOMER DATA PROTECTION**
  Large corporations have not been capable to keep private information secure. The mistrust is spreading and reaching new heights. In Dec 2017, the Identity Theft Resource Centre - ITRC reported that there were 1,293 total data breaches, compromising more than 174 million records included business, government, military, health and banking [30] across the world. That's 45% increase in breaches compared to 2016. The society deserves to reap the benefits of blockchain.

INHIBITORS

In this section is listed some of most relevant factors delaying the deployment of blockchain:

- **LACK OF GOVERNANCE AS A LIABILITY**
  Historically, governments have been unique in mass trust production. Through the people representatives who create the laws and the regulations. These are the legal consensus for the society, and may change for each jurisdiction. It does not sound rational that Cryptocurrencies remain unregulated. Banks and every financial institution are enforced to follow strict anti-money laundering and know-your-customer regulations (AML and KYC). Corporations must pay taxes on their profits and ensure consistency across a range of disciplines. On the other hand, some cryptocurrency advocates seem to broadcast the idea that because blockchain is decentralized it qualifies itself to be free of complying with any regulation. Or because blockchain relies on codes and cryptography, and being stateless, it implies in no obligation to any government. There are several flaws in this line of thinking: (a) government represents the society, (b) the society deserves protection against digital scammers, (c) protection against black market payments for unlawful products. Besides blockchain relies on Internet which can be discretely controlled by government. By undermining government regulation, blockchain is creating a false expectation to society. Blockchain cannot and should not be free from regulation. Governments will soon interfere and re-stablish its position to create mass trust.

- **SUSTAINABILITY & SCALABILITY LIMITATIONS**
  Electricity is a key environmental concern in every major country. High usage of energy resources for no direct good to the community can be seen as a wastage. According to recent indicators, Q2_2018, Bitcoin alone is consuming 70 TW/h [31] which is equivalent to what countries such as Austria or Chile consumed in 2016 [32]. Considering that Bitcoin processing capabilities averages 3 transactions per second [33], and that Visa averages 1736 transactions per second [34], it is possible to make an educated estimation that should Bitcoin scale to the same level of Visa in terms of processing capabilities, it would be consuming 40,509 TW/H. This is equivalent of 1,127 nuclear plants of the size of Palo Verde, Arizona, the largest power plant in the USA. It makes no sense that government continues to subsidy electricity costs for business that brings no direct good to society.

- **ICO PERCEIVED AS A PURE GAME**
  The fact that cryptocurrencies and ICOs are unregulated, creates an ideal environment for money laundering and high-risk gamblers. The volatility of the tokens is easily fabricated. Bad actors create the ideal condition for selling and buying tokens and manipulate their values. As tokens are unregulated, it just becomes a pure game and that's the image perceived so far.

- **BLOCKCHAIN PERCEIVED AS A BUBBLE**
  The volatility, high gains and vulnerabilities are daily covered in the media. It makes difficult for the public to differentiate the hype from real. All technicalities, such as immutability, decentralization, global consensus, etc. have no meaning to most of the public. History shows that the high profitability of token is not sustainable. Eventually the hype will achieve its plateau, and on the downturn, some players will be unhappy. Blockchain is perceived as bubble build out of an unregulated game. The bubble effect will have to be stopped at same time.

- **USABILITY & MERCHANT ACCEPTANCE LIMITATIONS**
  Blockchain conveys some similarity with the Internet in the early 90's when a regular user had to undergo 5 to 10 steps until gets the modem connected to an ISP and send a message. Every cryptocurrency is linked to its own native blockchain. Each network carries their own rules, welfares, risks and vulnerabilities. First the new user must learn about the type of wallets, if a cold, hot or hard wallet, etc. Next, one needs to sign up with a wallet service provider and a money exchange service provider. Then, one needs to learn how to connect and make transactions. Management of passwords, tokens can be challenging. It can take a week (or more) until someone is ready to start using the system. A simple mistake, passwords can be lost, and funds are gone. In the end, the new user learns that only a very few merchants accept cryptocurrencies. The overwhelming information makes no easy for a new user (or the merchant) to enter the cryptocurrency's world.

- **DEPENDENCY ON THIRD -PARTIES**
  It is impracticable to use cryptocurrencies without signing up with a third party for wallet services or currency exchange. It involves sending private information, such as passport numbers, drive license, credit cards, to third parties which will be then passed to many other parties in chain. It becomes risky as most of these intermediaries are small companies, that relies in outsourced databases, development team, network security, and IT operations to outsiders. Scandals involving cryptocurrencies are very common. Most of them related to money exchange and wallet service providers. Mt. Gox, then the largest exchange in the world at the time, based in Japan, was hacked and shut down [35]. Many people lost their money and many other cases surfaced over the past years. It is difficult to set up an account, finding a merchant that accepts crypto payments, difficult to exchange without facing risks and complexities.

IV. CONCLUSION

Blockchain is an enabling technology that brings insights to new business opportunities in many fronts. It can be deployed in business, government, and communities. It suits any demand that requires a trusted ledger or P2P transaction mechanism. The biggest enabler for blockchain is the increased public demand for more effective methods to establish trust, increase transparency in the system and protect sensitive data. Government and institutions have not always been able to protect citizens against misuse of private data. Blockchain technology brings a glimpse of hope to end users. On the downside, the most inhibitor factors are (i) the difficulty in the usability and (ii) the dependency on third parties (wallet and money exchange) and (iii) scalability. When an exchange service provider (or wallets) is attacked,

it affects the entire community. It causes the snow ball or heard effect every time, bringing volatility, bad reputation, etc.

This research focused in three major segments of blockchain: (a) cryptocurrencies, (b) utility platform for the deployment of decentralized applications and (c) alternative business model for start-ups seeking fund raising. Nevertheless, in the (a) cryptocurrency space, market growth expectation is high; for the moment, as a form of investment rather than an alternative for fiat money. New cryptocurrencies have been frequently introduced, each one offering improvement. Gradually all current limitations will be solved and new ones will emerge. Acceptability will increase in the same proportion that the technology becomes easier to use and less vulnerable. As for the (b) blockchain as a utility platform of Dapps, the potential for growth is very high. Open sources software helps to lower the initial investment and reduce time to market of the product. Eventually Dapps will become the preferred option for developers. For last, (c) blockchain serving as a business model for start-ups, is a very new concept, one that did not exist a few years ago. Despite all the hype, risks and benefits associated, it is an evolving tool on a very dynamic space. One that continuously demands for innovative and bold solutions. ICOs, SAFT, ILP provide much faster alternative for start-ups seeking to raise funds. Overall, blockchain has plenty of room for growth and exploit a range of untapped possibilities.

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