

## Improving Access to Credit in Property Markets Using Blockchain

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**Key words:** Crowdfunding, Real Estate Development, Land Management, Property Taxes, Valuation, Sustainability, Financial Inclusion, Economic Development, Blockchain, Property Markets, Access to Credit, Dead Capital, Micro Lending, Cryptocurrency

### SUMMARY

The 2007 Nobel Peace Prize winner, Muhammad Yunus, emphasised that credit is one of the key pillars for relieving poverty. A large part of the world lives in poverty, lacking access to credit. Improving access to credit has been on high agenda of several international organisations and policy makers since many years.

Over the last decades micro finance has helped bring many of the poor into the financial system through the use of support groups, pooled savings and micro loans. Credit allows households to borrow against future income and firms to invest, for instance, in land and other infrastructural activities. Country's institutions and access to technology directly affect the availability of credit and the ability to use property as collateral for credit. Without the ability to use property as collateral for loans, the titles in owners' hands still represent "dead capital" – assets that cannot be collateralised or sold.

Access to credit and financial inclusion are closely related and needs to be available on a scale that corresponds to the development of the market. At the 2015 World Bank Group-IMF Spring Meetings, the World Bank Group and public and private sector partners issued numeric commitments to help promote financial inclusion and achieve Universal Financial Access by 2020 (UFA 2020). The proposal for an UFA 2020 may have significance towards improving the access to credit also in Property markets. Although Financial inclusion and personal identity initiatives take place primarily at national or regional levels the problem of financial inclusion is more global and requires a technological solution that is global enough and can be handled with immutability, trust and transparency. Over the years, technology has eliminated middlemen and increased efficiencies in a plethora of different industries and it has the potential to do likewise in the real estate industry.

The scope of this work is based on how strongly does the access to credit correlate with the different fin-tech frameworks like blockchain and crowdfunding in which lenders and borrowers operate? To explore alternate financial schemes independent of normal financial institutional funding method for better real estate management. Will added risk management mechanisms like crowdfunding insurance to safeguard the investor's interest lead to sustainable financing in real estate especially after recent hacks on cryptocurrency systems?

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## 1. INTRODUCTION

“Giving the poor access to credit allows them to immediately put into practice what they already know – to weave, to husk rice patty, raise cows, peddle a rickshaw. And the cash they earn is then a tool, a key that unlocks a host of other abilities and allows them to explore their own potential. Often borrows teach each other new techniques that allow them to better use their survival skills. They teach far better than we ever could.” - (Yunus, M, Banker to the Poor, p. 140 , 2003).

Access to Credit for the poor can lead to better property markets and hence a better finance systems. In this context the paper is organised as follows - In Section Factors contributing to property markets we discuss other works related to the betterment of the property markets, in the section parameters to Access to credit, we detail the parameters of access to credit and give an overview of the present factors that are directly affecting access to credit globally and their impact over time. In the section - The Blockchain Model the details of the framework is presented in detail to improve access to credit. In the section statistical results we present the values given to several parameters of the model and report the results of use of blockchain model to affect access to credit globally including analysis of the bitcoin real prices in mortgage markets, and robustness analysis. The conclusion of the paper are reported in conclusions and further research. Finally appendix deals with the calibration to some parameters of the model.

## 2. FACTORS CONTRIBUTING TO BETTER PROPERTY MARKETS

“The International Property Markets Scorecard Methodology is a systems analysis tool to measure the strength of institutional support for transparent, rational and effective property markets. It provides stakeholders with a visual representation of the status of the core elements necessary for sustainable property markets that help to distribute power and economic opportunity.



Figure 1 : Factors contributing to better property markets

Source : International property markets

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scorecard methodology by Center of International Private Enterprise (CIPE) and International Real Property Foundation (IRPF)

The Scorecard is meant to measure how policy decisions and levels of implementation affect property markets. It is not meant to provide specific guidance, measures or predictions of individual property performance and is only completely valid in the cities where field assessments have occurred.”

The scorecard methodology as shown in Figure 1 has specified that factors - as the core factors that are required to analyse the property markets across the globe.

In mathematical terms it can be defined as

Health of property markets = function  $f$  (Appropriate regulation, property rights, access to credit, effective governance, rational dispute resolution, financial transparency) where  $f$  can be defined as “health of property markets function” with the form based on knowledge of the parameters in the country.

### 3. SCOPE OF THIS RESEARCH

As the factors that govern the property markets are many, this research work bases its analysis on the factors related to access of credit to markets as stated in the International property markets score card designed by the center of international private enterprise (CIPE) and the International real property foundation (IRPF).

Mathematically scope can be interpreted as follows -

Health of property markets = function  $f$ (*Appropriate regulation, property rights, access to credit, effective governance, rational dispute resolution, financial transparency*) ----- (1)

Access to credit = function  $g$ (*access to banks, soundness of the banks, microlending of banks, credit bureau, Other sources including venture capitalists*)

where  $g$  can be defined as “access to credit function” with the form based on knowledge of the parameters in the country. ----- (2)

The World Bank Group-IMF Spring Meetings in 2015, made the World Bank Group, public and private sector partners issued numeric commitments to help promote financial inclusion and achieve Universal Financial Access by 2020 ( UFA 2020 ). The commitments emphasise the lack of adequate access to credit to many firm’s and individuals. While it is unclear about the exhaustive list of parameters that need to be included for strengthening access to credit function -

This paper explores if technology is seen as one of the additional parameters that can lead to better access to credit function. While each of the parameters related to banks, credit bureau and other sources are currently seen as not sufficient enough for Universal Financial Access in 2016, we

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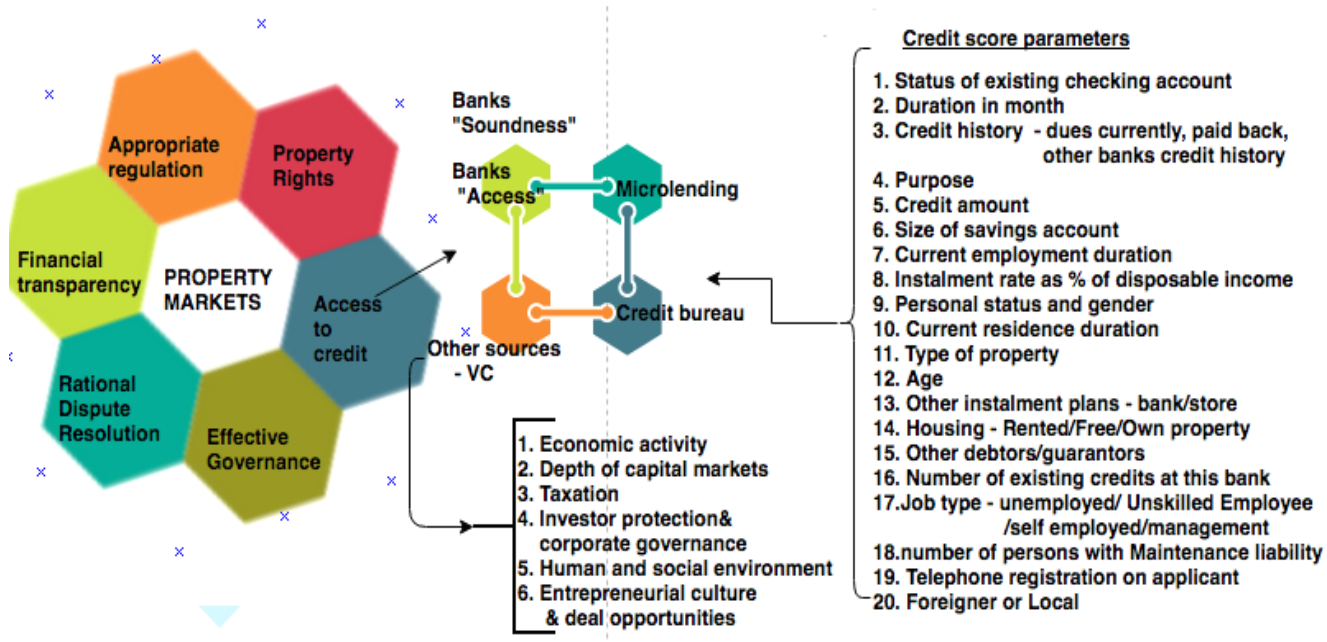
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propose and explore the technology as additional parameter in the access to credit function for higher Universal Financial Access in 2020.

Access to credit using blockchain = function  $\mathbf{b}$  ( *blockchain technology* , *access to credit function g*, *alternate credit scoring systems*) ----- (3)

This paper focuses on establishing the relevance of different fin-tech frameworks like blockchain and alternate financing in which lenders and borrowers operate for better access to credit. This work also explores the extent to which crypto-currency as a currency system could create sustainable financial schemes independent of normal financial institutional funding method for better access to credit in real estate management.

#### 4. PARAMETERS OF ACCESS TO CREDIT



**Figure 2: The parameters that govern access to credit**

As defined in equation 2 we studied each of the parameters of access to credit function globally.

Access to credit = function  $\mathbf{g}$ (*banks*, *credit bureau*, *Other sources including venture capitalists*)

Banks granting access to credit = function  $\mathbf{h}$  (*access to banks*, *soundness of the banks*, *microlending*) -----(4)

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The parameters affecting the other sources like the Venture capitalists and private equity as defined by Groh et al -

Venture capitalists and private index = function  $j$  (*economic activity, depth of capital markets, taxation, investor protection and corporate governance, human and social environment, entrepreneurial culture and deal opportunities*) ----- (5)

In Figure 2 we presented the framework and the parameters in nut shell that have direct and indirect effect on the access to credit and property markets. The function's  $g, h, j$  has further 20 sub parameters to define credit bureau scoring. We analysed the weights for the parameters in function  $j$  on the other sources that contribute to better access to credit.

#### **4.1 Parameters of banks leading to access to credit - Access, Soundness, Microlending**

The correlation of banks - access, soundness and microlending varies from country to country with developed countries showing strong correlation and third world countries exhibiting weak correlation. Three main components of the banks that could define better Access to Credit are

- 1) Banks
- 2) Credit bureaus
- 3) Other sources

Banks are the source of finances and are involved in the origination, fulfillment and servicing of the loans in the process of providing access to credit to individuals and SME. The sub components that define financial systems role in access to credit are as follows

- 1) Access
- 2) Soundness
- 3) microlending

##### **4.1.1 Access - The ease of obtaining a bank loan**

Traditional banking services define the core element of access to credit. They are the central pivot in financial intermediation between the deposits of savers and loans by borrowers and hence is one of the key components that lead to Access of Credit. The developing countries face major problems in providing sustainable access to credit. The interest rates are also very high in the developing countries. This makes the lending much lesser and also raises concerns in repayments.

###### **4.1.1.1 Control of Government over financial services**

Excessive banking and financial regulation by the state limits competition, impedes efficiency, and increases costs. Government ownership of banks and high levels of intervention in non- banking financial services undermines the ability of markets to provide services that reflect true market conditions and risks.

###### **4.1.1.2 Weak competition in banking systems**

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To a large extent, the slow development of nonbank financial institutions, instruments, and markets has been a result of the lack of enabling legislation in some key areas. The absence of legislation reveals the lack of interest by incumbent institutions in promoting alternatives to bank finance and enhancing competition in their own market. Stricter entry requirements, weak credit information systems, and lack of competition from capital markets and nonbanking institutions are very prominent in some regions especially the middle east. This will lead to lesser access to credit.

#### 4.1.2 Soundness of the Banks

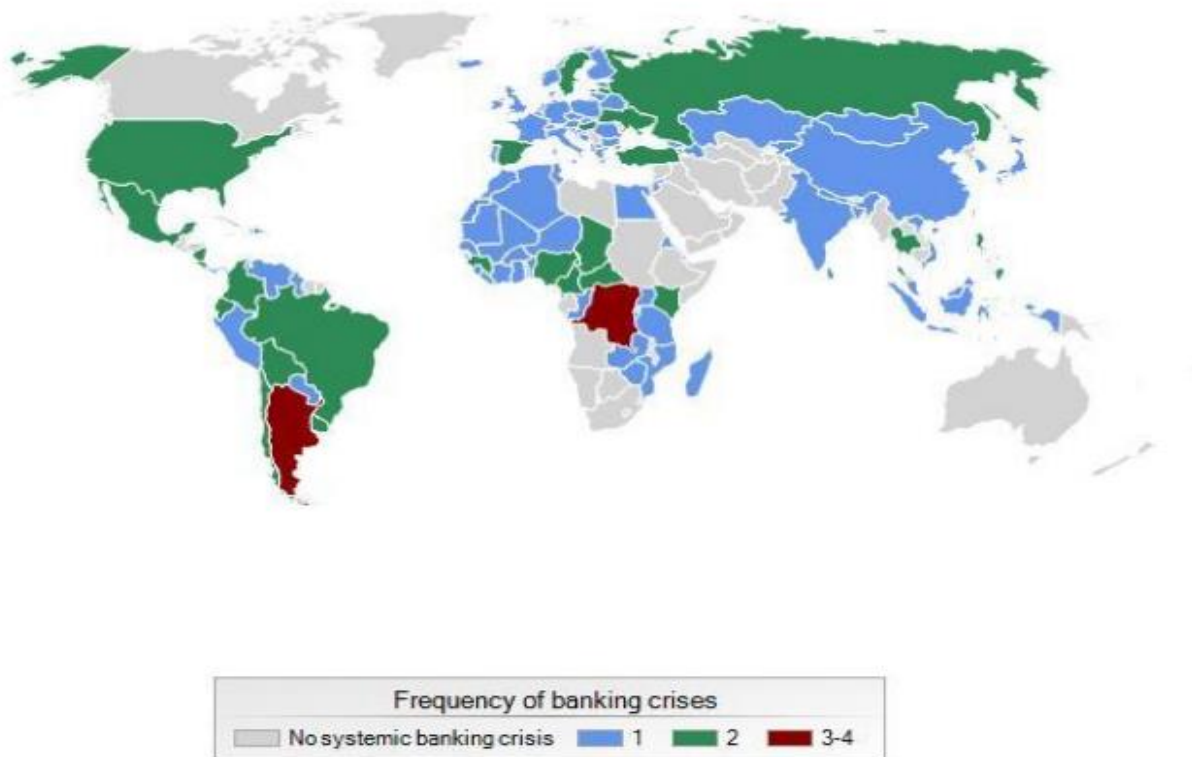


Figure 3 : Frequency of Systemic Banking Crises Around the World, 1970–2011

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Source : Laeven, Luc et al, 2012

Systemic banking crises is seen globally and most prominent in the parts of Africa and also in South America. While it can be noticed from the above figure that frequency of banking crises in the past 40 years is relatively less say frequency = 1 or 2 in most part of the globe, the access to credit may not be seen the same way.

“Banking crisis is marked by bank runs that lead to the demise of financial institutions, or by the demise of a financial institution that starts a string of similar demises” (Reinhart 2009). A typical banking crisis would mean no or lesser access to credit. A collapse in real estate prices can lead to

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deterioration of the asset values and hence crises – particularly systemic banking crises – lead to long-lasting economic contractions.

If banks experience a large number of defaults and repaying contracts on time - it is difficult then for non-performing loans may increase sharply and can lead to erosion of aggregate banking system capital. Further, it may lead to collapse of real estate prices on the heels of run-ups before the crisis, sharp increases in real interest rates, and a slowdown or reversal in capital flows

The resolution of a banking crisis entails a significant amount of costly government intervention. These fiscal bailouts are a significant social burden. The added public debt has to be serviced over time, which means that the social costs of systemic banking crises are very serious and may lead to lesser access to credit. Any lending practises during crisis situation may lead to unsustainable financing practices and hence repayments would be extremely difficult.

### **4.1.3 Microlending**

GHF in collaboration with UN habitat, has aimed to create housing for 350 million urban homeless slum dwellers that are employed or have a source of income. It creates an opportunity to own a sustainable home financed through 'micro-mortgage'. “ GHF's micro-mortgage program transforms large numbers of families from slum dwellers to proud homeowners. Their new home will provide them with safety, security and elevated social and economic status.” (CIPE, 2012)

A loan of a few hundred dollars for a poor family will buy them the ability to purchase at least lesser valued properties. According to several studies on the repayment of Microlending Micro-lending customers have excellent repayment histories. Micro-finance thus allows citizens without traditional creditworthiness to build a credit history and work toward participation in the traditional banking sector - a practise that can be viewed as leading to sustainable financing.

### **4.2 Credit Bureau - coverage and hindrances to access to credit**

The debt in a company’s balance sheet could include loans, overdrafts, trade financing, leasing, and factoring. Information needed to make reliable credit decisions includes a potential borrower’s income and the value of the collateral put up for a loan. To make the most reliable decisions and to price the potential risk, providers of credit also need to know information on a borrower’s credit history like - outstanding debts, debt repayments history etc

The credit gap is very high in the regions Africa and Asia with over 59% requirement and this can be also correlated to lack of adequate number of credit bureaus in these regions (Stein, Peer et al 2010). High income OECD countries, Europe and central asia has high number of credit bureaus as shown in Table 4 of the Appendix 2 and so has lesser credit gap meaning to say strong Access to credit. The 20 parameters that could be used for credit scoring has been indicated in the framework in Figure 2.

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“SMEs in the developing world were having trouble growing not because they didn’t have the capacity to excel, and not because financial institutions weren’t eager to invest in them, but because there were no tools with which lenders could determine which businesses were safe, and which businesses were risky in a consistent and scalable manner” (Stein, Peer et al 2010). This observation indicates inadequacy in infrastructure and technology.

#### 4.2.1 Inadequate Financial Infrastructure and Technology

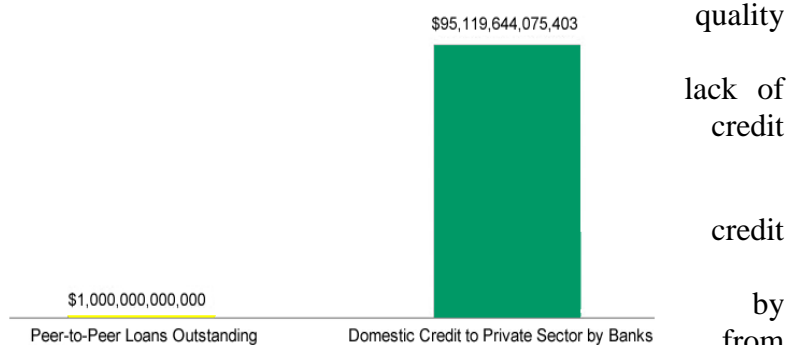
The absence of solid credit information, lenders adopt defensive positions, requiring substantial collateral, increasing interest rates, or rationing credit, all of which hinder the growth of segments like real estate too. Table 4 in Appendix 2 gives the number of reporting systems across regions revealing the inadequacy in financial infrastructure as around 25 are not available or are considered as negligible coverage especially in Africa. In addition to effective credit information and collateral regimes, mortgage finance requires physical identification of properties (cadastres) and clear definition of owners (titling), constraints on land availability can be due to physical factors and/or to policy weaknesses and is widely seen across regions.

#### 4.2.2 Missing institutions and markets

In addition to the parameters of the credit scoring, loan applications gather the data using: a borrowing history, a credit score, financial statements, and collateral. There has been a general consensus that this system works relatively well in the developed markets. As the access to the information is relatively good, banks have no problem determining who should get a loan and who should not. In case of the emerging markets the Credit bureaus are less prevalent, regulations are less established, information sharing across institutions is hampered by data and other technological hurdles. Securitizing loan with the credit data is hindering access to in Real estate.

Figure 4: Estimated outstanding bank and marketplace loans by 2025

Sources: Domestic credit provided financial sector in percent of GDP World Bank, extrapolated to 2025



with a constant growth rate of 3%, which is lower than the current growth rate predicted by “IMF World Economic Outlook (WEO) Update: Cross Currents January 2015“; “Marketplace Lending, Financial Analysis, and the Future of Credit.

Figure 4 is the projection of the growth in the domestic credit to private sector by banks indicating the severe stress that may be created on access to credit due to the loans outstanding.

#### 4.3 Other sources

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Real estate entrepreneurs are free to raise capital from other sources like venture capital and/or by issuing stock in a well-regulated stock exchange. One such study that identifies the parameters that affect VC funding in a country has been presented below

#### 4.3.1 Ease of finding venture capital for entrepreneurs

The main parameters for VC/PE attractiveness index are - “1. Economic Activity, 2. Depth of Capital Market, 3. Taxation, 4. Investor Protection & Corporate Governance, 5. Human & Social Environment, and 6. Entrepreneurial Culture & Deal Opportunities.” (Groh et al, 2016). These six key drivers are divided into subcategories as shown in Appendix 1. The correlation between each of these indicators to the VC/PE attractiveness index score is defined by the weights presented in Table 1 of the Appendix 1. Regionally we observed North America ranking top and Africa at the bottom of the table rank in the VC/PR index. The weights corresponding to Depth of capital market and the entrepreneurial culture are very high.

“There is dispersion in all the six key drivers across Europe. Some countries attract investors with low corporate taxes. The Nordic countries are especially strong in Entrepreneurial Culture. There is some dispersion in Economic Activity, and in the Human and Social Environment. However, the two key criteria, Investor Protection and Corporate Governance, and Depth of Capital Markets, make the difference. The United Kingdom clearly dominates all the other countries regarding these criteria while their taxation score is below the European average, and while the other criteria are on a par.” (Groh et al 2016)

The Other sources are highly correlated to the Depth of the capital markets and Entrepreneurial culture in the country with Cronbach's alpha coefficient of 0.73 and 0.785 respectively.

Depth of capital markets = function  $k$ ( *Size of the stock market, Stock market liquidity, IPO's and public issuing activity, M&A Market activity, Debt and Credit market, Banks non performing loans and financial market sophistication*) ----- (6)  
where function  $k$  is the regression function for depth of capital markets.

Entrepreneurial culture and deal opportunities = function  $l$  ( *Innovation, Scientific and technical journal activities, ease of starting and running a business, simplicity of closing a business, corporate R&D*) ----- (7)

where **function  $l$**  is the regression function that defines entrepreneurial culture and deal opportunities.

#### 4.3.3 Ease of issuing shares in stock markets

Another source of the financing is the issuing of shares in stock markets. As companies develop and highly competent management teams execute well-developed business models, they can grow to the point of going public with an initial public stock offering (IPO) to raise more capital for continued

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growth. Investment banks and teams of analysts need to be in place to support IPOs. IPO's are at times of growth trajectory of the maturity of company, considered a good source of fund raising if the company's have a good product to offer and has gathered sufficient attention from the investors.

## **5. ROLE OF BLOCKCHAIN IN ACCESS TO CREDIT**

Principle 6 of UNECE policy framework mentions that access to credit and mortgages as well as microfinance for low income earners are essential elements of a healthy real estate markets. It is in this context this research work explores role of fin-tech as one of the means of sustainable financing for small and medium enterprises in real estate markets.

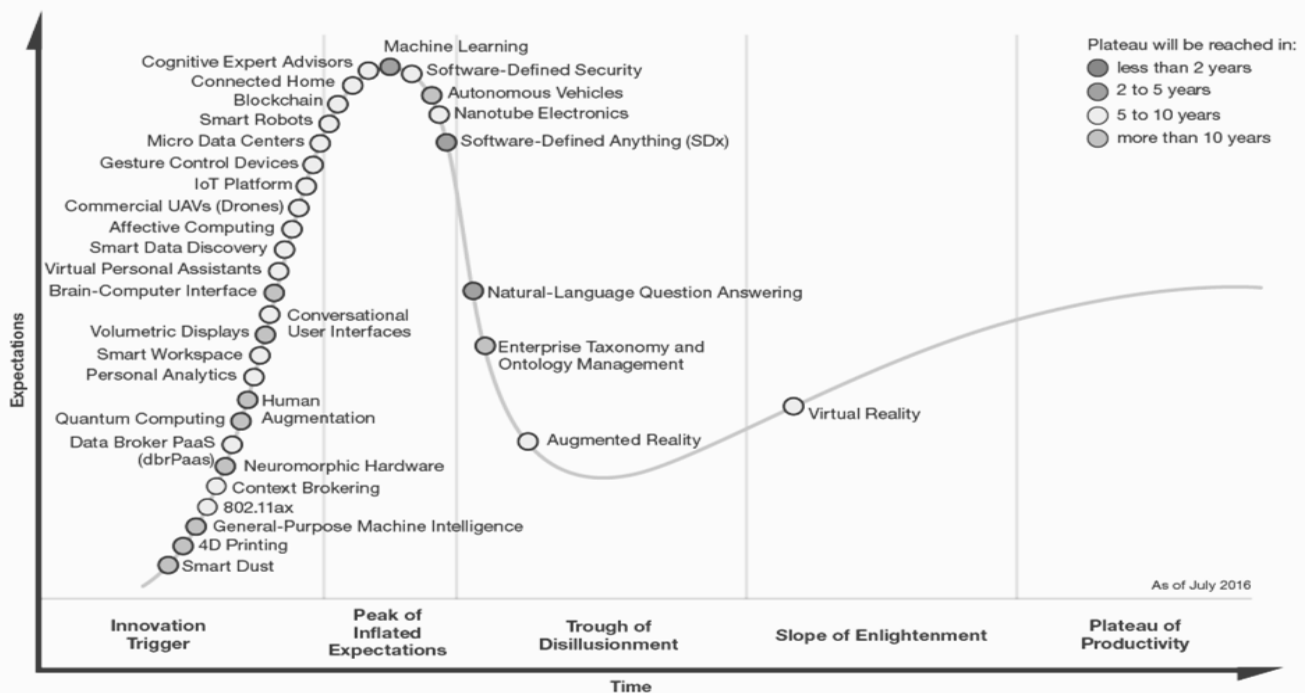
### **5.1 Disruptive technologies - hype cycle**

Several disruptive technologies can be used in Real estate. Some of the technologies as shown in the Figure 5 from Gartner - are positioned at different positions in hype cycle as presented Gartner. While Machine learning peaks the hype cycle and it may take less than 5 years to reach the plateau of productivity. Blockchain is considered an emerging technology with a potential to become a peak of inflated expectations soon and will reach productivity in less than 10 years. It is in this context it is relevant to understand its contribution in improving access to credit.

Blockchain is a distributed ledger that enables communities to record and share information. Members maintain their own copies of the information and must validate any updates collectively via a shared consensus mechanism. The information could represent bank transactions, smart contracts, real assets, digital identities, or practically anything else that can be described in digital form. Entries are permanent, transparent, and searchable, which makes it possible for community members to view transaction histories in their entirety.

Figure 5 : Emerging technology hype cycle for 2016.

## Emerging Technology Hype Cycle for 2016



Source: Gartner  
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Gartner

Block chain's consensus algorithms are technically pending updates are queued and processed by distributed nodes called miners, who are running algorithms performing puzzle-like hash routines that require brute-force effort to fulfill the conditions of the underlying rule set. Miners who successfully announce solving the puzzle provide a record of programmatic effort to validate that they genuinely completed the task. This explains why blockchain is sometimes described as a "proof of work" protocol

Blockchain currencies aren't paper that are later represented by software and hence highly programmable. The power of cryptocurrency is you can program it to escrow and distribute itself. With fiat (Non- crypto) money, you need humans and banks. Bitcoin has a function called multi-signature. In bitcoin, you use your private key to approve the sending of the digital currency to another person. With "multisig," you can create a transaction with three private keys, where at least two are required for spending. Bitcoin isn't held in bank accounts but in a digital wallet stored on your computer or smartphone. By using bitcoin, real estate escrows can be done more securely, quickly, and cheaply. Bitcoin is Money 2.0 also because it's censorship-resistant.

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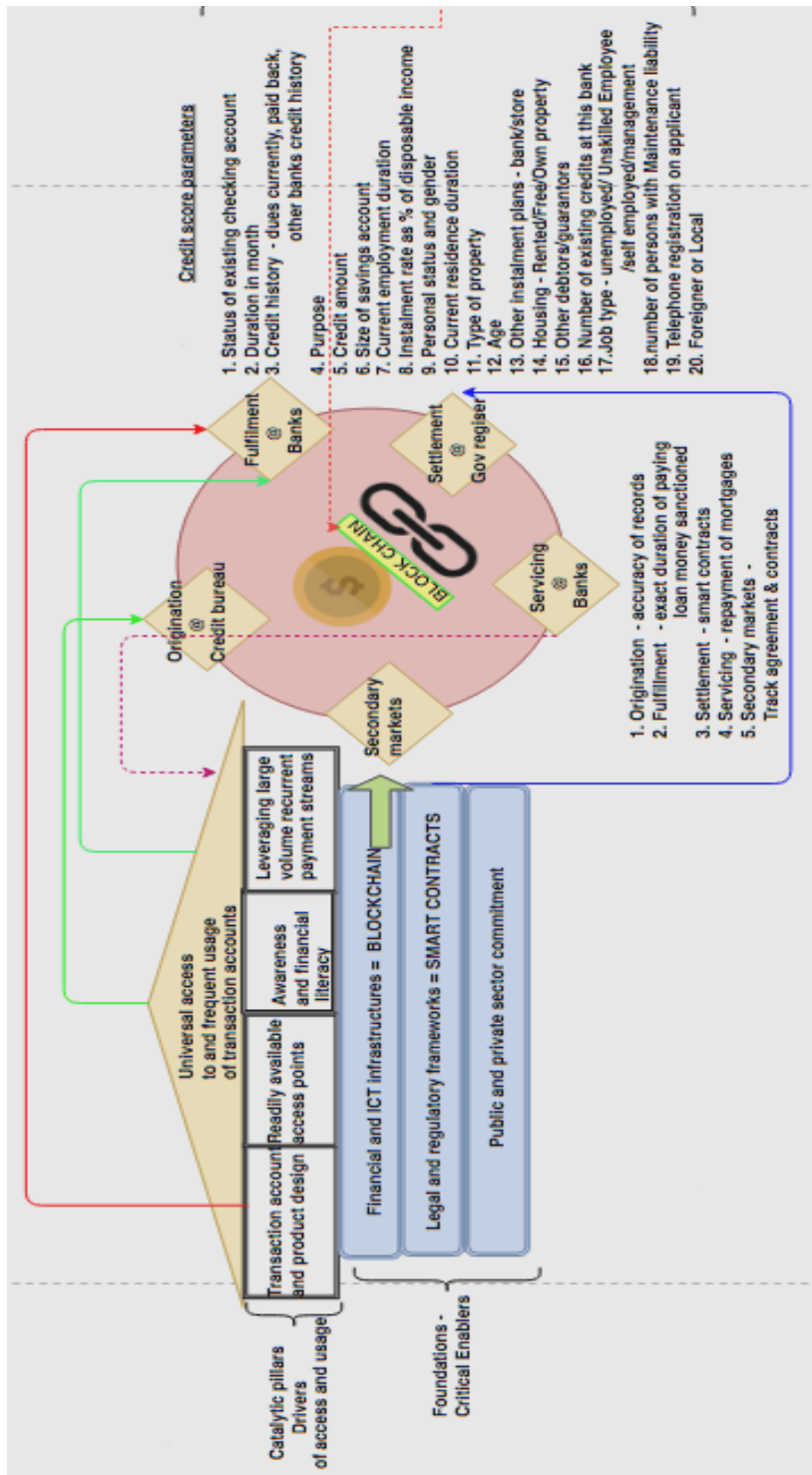


Figure 6 : Universal financial access to credit using Blockchain

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## 5.2. Framework for universal financial access using blockchain

At the 2015 World Bank Group-IMF Spring Meetings, the World Bank Group and public and private sector partners issued numeric commitments to help promote financial inclusion and achieve Universal Financial Access by 2020 ( UFA 2020 ). The proposal for an UFA 2020 may have significance towards improving the access to credit also in Property markets.

“Developing and accelerating electronic merchant payments at the broader level can help countries advance financial access and financial inclusion.... Using basic payment or savings accounts can gradually lead to access to and usage of other financial services, such as credit, insurance or pensions. The three foundational enablers are also highly relevant levers for helping to improve the usage and adoption of electronic payments by merchants” (WorldBank, 2016).

Figure 6 emphasises on framework for using blockchain to improve the access to credit through universal financial access. To make responsible credit decision, banks and non-bank financial service providers during origination need accurate, accessible data in standardized formats on actual sales prices and operating costs for properties. Foundations like the Financial and ICT framework, Legal and regulatory framework, public and private sector commitment are the critical enablers for universal financial access.

For an increase in the frequency of transactions require catalytic actions like the transaction account and product design, readily available access points, awareness and financial literacy, leveraging large volume recurrent payment streams. the catalytic pillars are the drivers for access to change in credit.

## 5.3. Block chain for change of access to credit framework

As earlier identified control of government over financial services, weak competition amongst banks, inadequate financial infrastructure and technology and the missing institutions and markets are some of the reasons for inadequate access to credit. Universal financial access and frequent usage of transaction accounts can lead to better origination, fulfillment, settlement, servicing and creation of secondary markets as shown in Figure 6.

Blockchain-based property title systems (such as land registries) could open up normal bank financing to people who otherwise cannot get access to credit from financial institutions. It is acknowledged that blockchain 2.0” could be used as a remittance system and as an alternative bank account. For example ubiquity platform creates a permanent, immutable ledger of ownership information that can not be changed, lost, or corrupted because it is permanently recorded on the peer-to-peer Bitcoin blockchain. The increase in alternative bank accounts are directly possible due to increase in e-wallets. There has been proofs as shown in Figure 7 that e-wallets has been increasing over time. An each e-wallet could lead to new account powered by a mobile device.

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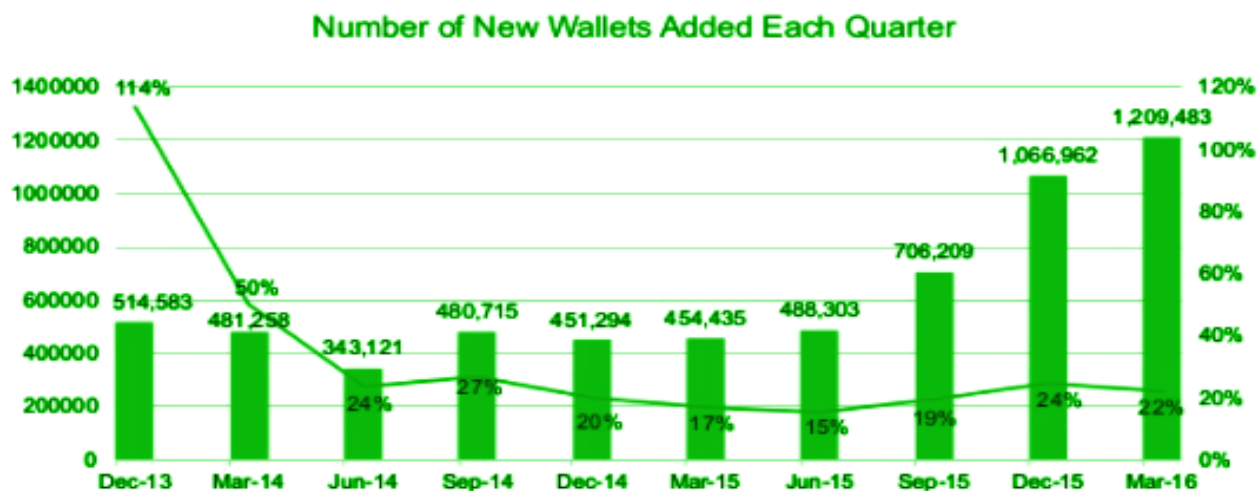


Figure 7: Number of new wallets added each quarter. Source : Coindesk, 2017

To make responsible credit decision, banks and non-bank financial service providers need accurate, accessible data in standardized formats on actual sales prices and operating costs for properties. Well trained, independent and ethical asset valuers must be in place. Transparent financial reporting by public companies, continuous development of financial markets and processes for the orderly dissolution of companies and the redistribution of assets also are needed. This can be ensured by distributed ledger system advocated by the Block chain. Over the last decades micro-finance has helped bring many of the poor into the financial system through the use of support groups, pooled savings and micro-loans. This entire process can be names as origination of access to credit. Real estate lending is based on the valuation of the property and the banks margins and acceptance of the valuation. Proper record keeping would mean proper valuation records too and hence good percentage of financing.

Regulations and conditions if not met can lead to exclusion of the loan being sold into the mortgage backed security pool. Access to credit is based on the credit scores received by the applicant. these credit scores are entirely rely on the accuracy of the source data. It could be seen that enhanced record keeping, time stamped disclosures after granting access to credit, smart contracts for streamlined settlement flows, tracking payments during mortgage servicing, tracking the agreements in the secondary markets are all crucial for better access to credit. Increased use of wallets would mean increasing use of transaction accounts and hence each user has an established credit score. This trend has been in increasing growth pattern as shown in Figure 8. After credit scores are met the fulfillment is to be met by transfer of the loan money sanctioned to the lender.

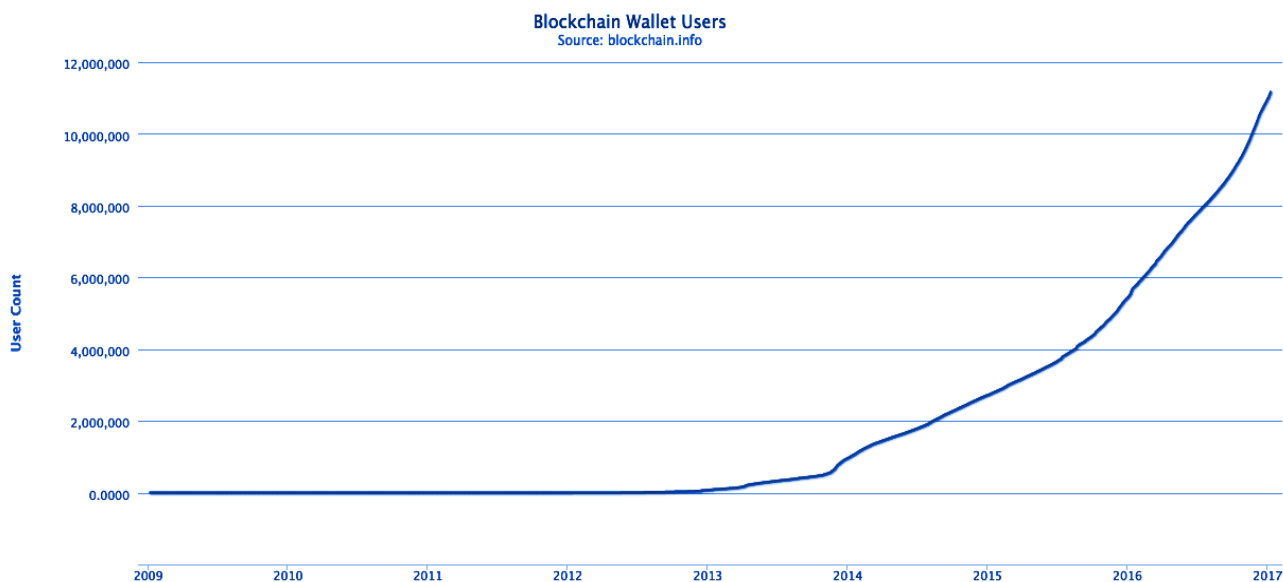


Figure 8 : Raise of Blockchain wallet users since 2013.

Currently in most of the countries mortgages has to be endorsed by third parties. So technology could be used to provide immediate update of the ledgers with transparency and traceability. Smart contracts could lead to automated mortgage process thereby improving access to credit and settlement process. Having a third-party intermediary involved in a mortgage transaction can cost as much as 1% to 2% of a property's value. Blockchain could reduce or eliminate the need for a third-party intermediary in the mortgage process and instead allow two parties to interact directly instead.

Transparent financial reporting by public companies, continuous development of financial markets and processes for the orderly dissolution of companies and the redistribution of assets also are needed. This can be ensured by distributed ledger system advocated by the Block chain. Transparency of registrations and information on data of all different real estate transactions (sales and rental/leasing) need to be ensured.

The more a market is open and transparent (and also accessible to foreign buyers), the more numerous the opportunities exist to have a functioning real estate market and realistic selling prices. Real estate appraisals and risk evaluations can be conducted by independent experts and be transparent and public to the investors. As the financial system becomes more sophisticated, inflation rates subside, property values start to go up and robust primary mortgage markets evolve into secondary markets where loans can be pooled and securitised into additional capital. This could lead to opening up of mortgages to secondary markets aided by tracked agreements and contracts.

### 5.3.1 Case study : Is Ghana an improved access to credit system due to blockchain?

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Based on the Scorecard case-studies Ghana is analysed to understand the strength and weakness of contributors to access of credit.

Access to credit = function  $g$  ( Strong credit bureau - 23/185, weak Banks, strong other sources )

*i.e*

Weak Banks = (weak soundness of banks= 5.05/7, weakest access to banks = 2.03/7, very strong microlending)

very Strong credit bureau= (very strong private credit information & coverage = 5%, strong public credit information)

Strong other sources = (very strong equity investors = 4.03/7, strong financial freedom = 60/100 with limited government control, weak venture capital = 2.09/7)



Figure 9 : Ghana scorecard with intensity of colours reflecting access to credit in property markets

It is estimated that today in Ghana around 78% of land is unregistered. A new Blockchain-based initiative in West Africa aims to stamp out corruption and is touting to “free up trillions of dollars” in locked capital for infrastructure development. Ghana’s Land Administration Project has for the past 17 years to try to solve the land dispute problem. But corruption and nepotism have plagued every area of the public, so that they have had Overtime Rule difficulty accomplishing their goals and consolidating the land title tracking system. A danish crypto exchange CCEDK paired with Bitland, is aiming to register land titles to a public blockchain, so that is not only public – but immutable.

In this ecosystem, land could be held as equity, as currently no banks are really willing to lend against unregistered lands. Bitland will be issuing a digital currency called Cadastrals, which will act as the entry token for their blockchain platform. Cadastrals have been specifically created to be the token that represents the Bitland Ecosystem and have not been used before. Bates reveals that the price in Phase 1 will be 10,000 satoshi (\$0.04 USD) and Phase 2 it rise to 30,000 satoshi.

A planned launch of the crowdfunding campaign for a new initiative, ICOO. This innovative new asset will allow holders to benefit from future ICOs, by investing in them and making proxy tokens available to trade before they launch. The fund will purchase assets from supported ICOs and create tokens representing these on Open Ledger in the period before the official release of the project. As with other new projects, a proportion of ICOO assets are reserved for OBITS – a catch-all asset representing all current and future initiatives in the CCEDK network. The Secondary markets

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created due to blockchain can be interpreted as creating avenues for alternate finances as shown below in the figure 8 on bitland charts

## Bitland Charts



Figure 10: Bitland charts price and market cap variation since two months

### 5.4 Correlation with the different fin-tech frameworks like blockchain

An efficient, transparent financial sector is one that provides a broad range of citizens with access to multiple forms of competitive credit so that they can purchase property. Legally protected, secure and standardised recording of property rights is only the first step in building property markets. Without the ability to use property as collateral for loans, the titles in owners' hands still represent "dead capital" – assets that cannot be collateralised or sold. This is perhaps the point at which blockchain can ensure the transparency and efficiency of the financial sector.

“ Ultimately, people will be able to use their mobile devices to register a plot of land with GPS accuracy, file a claim, register a dispute, sell or purchase land. As well as the transparent and immutable nature of the blockchain, OpenLedger allows smart contracts” (Boesing, 2016) This removes the need for trust, so that microloans can be issued and government contracts fulfilled on a platform that tracks progress and distributes funds accordingly. So it clearly shows that Blockchain has a positive correlation to financial inclusion in case of providing access to credit even in case of unregistered land.

The lack of financial infrastructure and technology can lead to increased peer-to-peer loan outstanding and domestic credit to private sector by banks. Without fin-tech supported databases of true market data and highly-trained property market analysts, markets will be slow to develop and

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be vulnerable to extreme cycles of boom and bust as well as longer periods of recovery. It is in this context, blockchain could aid in data mining.

The weaker access to credit can have improved access to credit if financial infrastructure and technology can be improved and thus becomes a case for use of Blockchain to improve the access of credit. Hence the correlation of blockchain to access to credit is seen very strong in Africa and Asia as the financial infrastructure and Land title registration infrastructure is deemed to be less in these regions.

## 6. IS

Loan refinancing					58%
Credit card payoff					28%
Home improvement			4%		
Small business loans		1%			
Other				9%	

## BLOCKCHAIN ALWAYS SECURE ENOUGH FOR ACCESS TO CREDIT ?

Figure 11: uses of market places loans, Source : (Stagars, 2016)

The uses of market places loans are highly seen in loan refinancing and the least for small business loans. “Creditors use marketplace loans for smaller purchases, while mortgages remain the sole provenance of banks — for the time being. Several marketplace lending entrepreneurs felt to avoid direct competition with banks. They prefer to serve a small segment of the credit sector that banks have little to no interest in. Marketplace lending is an explosive idea with enormous potential.

Cost reduction and lower interest rates for credit are the obvious benefits, but opening up private and commercial debt to retail investors as an investable asset class is revolutionary. By allocating a few hundred dollars to a fixed-income portfolio, individuals can transparently select and pool themselves — as with marketplace lending — in areas that have long been the exclusive domain of large institutional investors or private banking clients. Marketplace lenders should embrace this disruptive potential and stretch a little farther to strengthen their business model.” (Stagars, 2016)

### 6.1 Alternate financing using Blockchain 2.0.

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Crowdfunding powered by blockchain technology in short term can lead to a decentralized bitcoin ecosystem, and actually address scalability issues. In the long run, it will give the opportunity for individuals and enterprises to raise investment and to actually benefit from valuation appreciation.

Kickstarter, Indiegogo and all the other traditional platforms act as trusted third parties to enable a crowdfunding campaign. Crowdfunding platforms powered by blockchain 2.0 technology bypass the requirement of third party trust. They allow individuals in property markets to raise funds by custom made digital currencies and selling “cryptographic shares” to early backers. In more intelligible words, this means that investors in a crowdfunding campaign of the property get tokens that represent shares of the property they support and can actually benefit from the token value appreciation.

## 6.2 Block chain hacks - is it alarming and need for ISO

The 2014 collapse of Mt. Gox — then the world’s largest bitcoin exchange — following the theft or disappearance of nearly \$500 million in bitcoin, is a conspicuous example of such risk. Ethereum crash of 17 June 2016, which – after possibly a hack or more likely an error in the code – allowed about USD60 million worth of the Ethereum digital currency to be diverted to an unintended recipient.

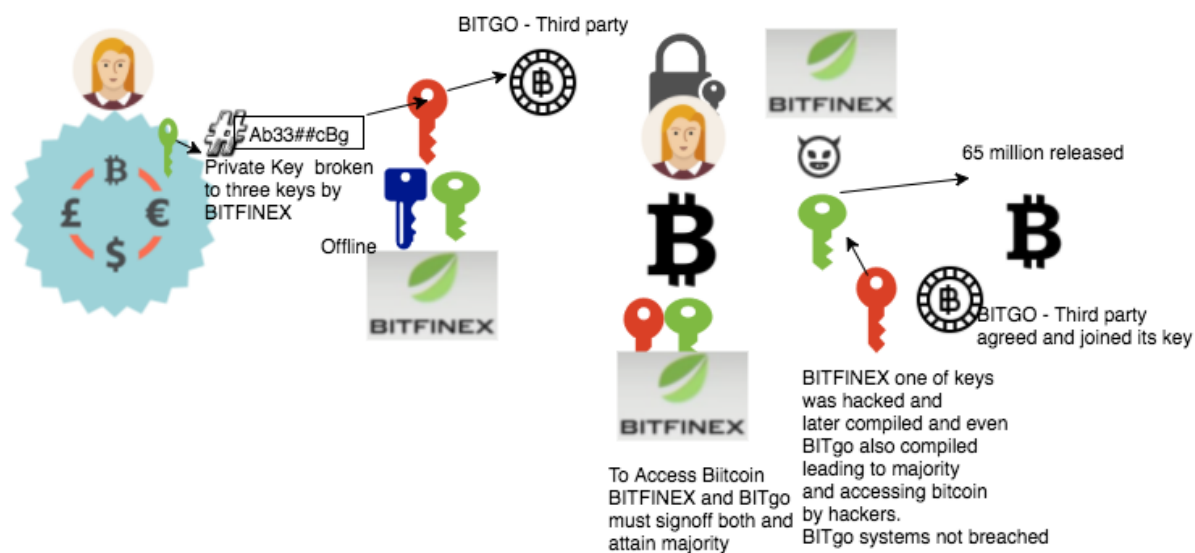


Figure 12 : Details of the Ethereum hack.

The community reacted by adopting a so-called hard fork through migrating users to a theft free version of ethereum. An important achievement of this process returns approximately \$40m worth of ether from an account owned by an unknown hacker to a new address. Although this is being met with celebration by many members of the ethereum community, the decision triggered a rebellion from a significant chunk of the community as it is seen as a violation of Ethereum’s free market ethos and essentially showcased possibility to alter history of immutable blockchain.

While many scholars challenge the block chain link to financial services as unsolved because of the hacks - it can be seen as an opportunity to improve the security systems to make this futuristic technology more robust and free from stealing. In traditional banks - history always showed that hacks are prominent across the globe and so every technology may not be foolproof. China may have got lot of attention for its recent hacking activity, the US remains firmly on top too in terms of sheer volume. This remains true for rankings tabulated by different think-tanks like Symantec and NCCGroup. Usual suspects China and Russia are consistently within the top five, while Germany and the UK show up consistently within the top ten. So even traditional banking internet software are prone to hacks. The security standard for each of these systems keep evolving as technology evolves too.

Blockchain creates new business and delivery models which may require changes to policy and regulations. But this is only part of the solution. Blockchain needs international standards that are compatible with regulations and controls in financial systems to ensure market confidence and consistency in the use of this technology.

“[...] Blockchain is still an emerging technology and issues such as data sovereignty, privacy, and lack of consensus... Australian stakeholders and government want this technology to be sustainable...The proposed international standards (ISO) for blockchain will focus on technical solutions that promote interoperability, and compatibility between existing systems. This will allow the technology to be more widely used and deployed.” ( Megeurditchian , 2016)

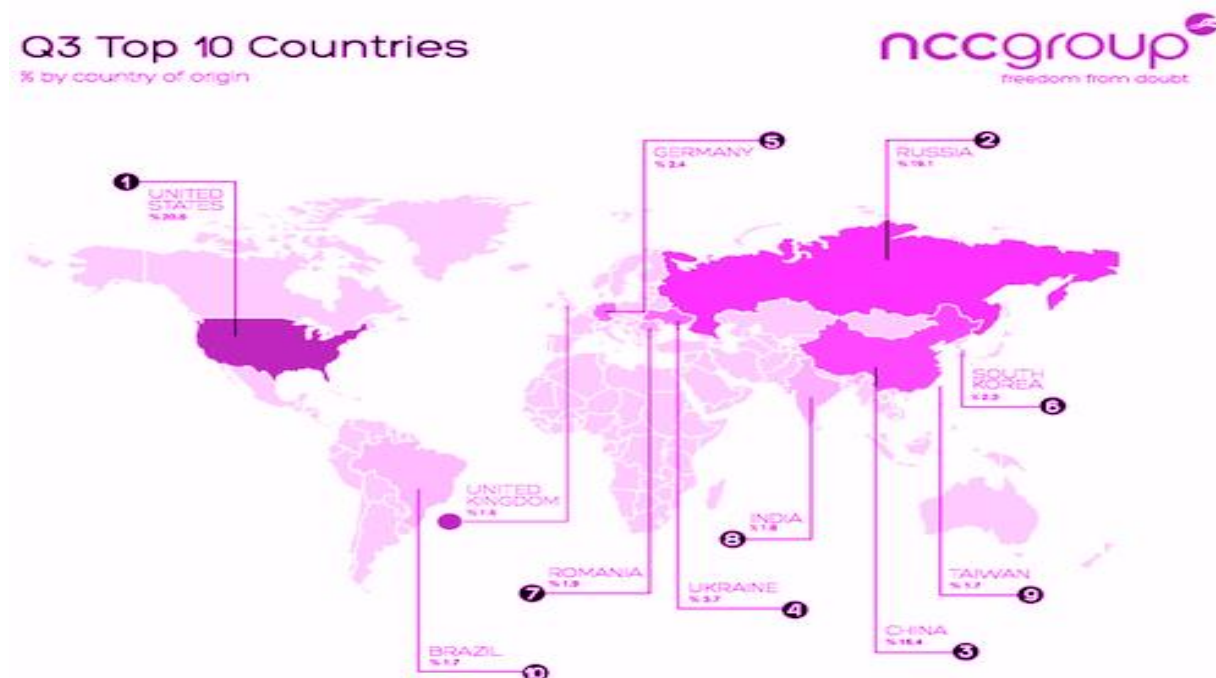


Figure 13 : Top 10 countries and % of hacks globally - country report by NCC group 2012 (Breedon et al , 2016)

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### **6.3 Risk management of other sources of access to credit**

Alternative financing portals should be encouraged to purchase professional liability insurance in addition to the bond. In addition all companies, should investigate employment practices liability insurance if the portal has employees, Directors and Officers Liability insurance. “Elliptic is a London-based bitcoin company that offers a “vault” service, and Xapo also offers enterprise-level insured bitcoin storage that can be used by exchanges. In fact, Coinsetter offers insurance on 50% of all bitcoin deposits thanks to a partnership with Xapo. When it comes to exchanges, Coinsetter is currently the option that offers the largest amount of bitcoin coverage for traders. If we expand the conversation to US dollar deposits, then it should be noted that Coinbase Exchange and the upcoming Gemini exchange both offer FDIC insurance to their users.” (Torpey, 2015)

Investors should liaise for including insurance coverage available to cover : cyber liability, commercial crime, professional services; directors and officers, and commercial general liability for all those activities involving cryptocurrencies and/or distributed ledger technology. An insurance policy that can cover Crime policies that include bitcoin and other cryptocurrencies could back the risk of losing money due to hacks.

## **7. CONCLUSIONS AND FURTHER RESEARCH**

As finance systems develop, property becomes more liquid – homes can be mortgaged for business start-up capital, to finance property improvements and to eventually allow owners to transfer up the property ladder. As banks develop loan repayment histories and understand credit risks, interest rates stabilise.

The scorecards from CIPE allow us to know the strength or weakness of contribution of access of credit to property markets, the exact correlation numbers are difficult to compute as the parameters of comparison is not normalised. However it can be deciphered that access of credit relies on financial transparency and henceforth the later becomes important for financial inclusion to be attained. A detailed correlation matrix pinning to numerical values for analysing the exact extent of correlation of fintech to improve access of credit is possible and could be explored on a case-by-case approach for future studies.

Block chain’s consensus algorithms require more computing power and introduce delays. The distributed ledger system that protect blockchain and lead to transparency could also lower performance and limit scale due to wrong implementations. So high- volume, latency sensitivity transactions for this technology might not be a fit for blockchain. In addition, blockchain architects and information security teams need to design blockchain solutions fit for the purpose and not as addressing all the issues of financial infrastructure.

Despite two or three security breaches, cryptocurrency and rapid emergence of distributed ledger technologies will continue to evolve and it is clear that these technologies will be a part of the digital economy for next 20 years or more. Like every life cycle process of any technology, risks

associated with blockchain technology in property markets also will come into sharper focus as these industries continue to expand.

Developing adequate tools, including insurance policies, to deal with the risks is mandatory if involved in the secondary markets using crypto currencies although some time property markets use of block chain can just focus only on primary markets using blockchain. As one blockchain may not fit all so does the policyholder's existing program and so their options for additional coverage needs to be reviewed and ensure that such risk management tools are in place always before investing to secondary markets.

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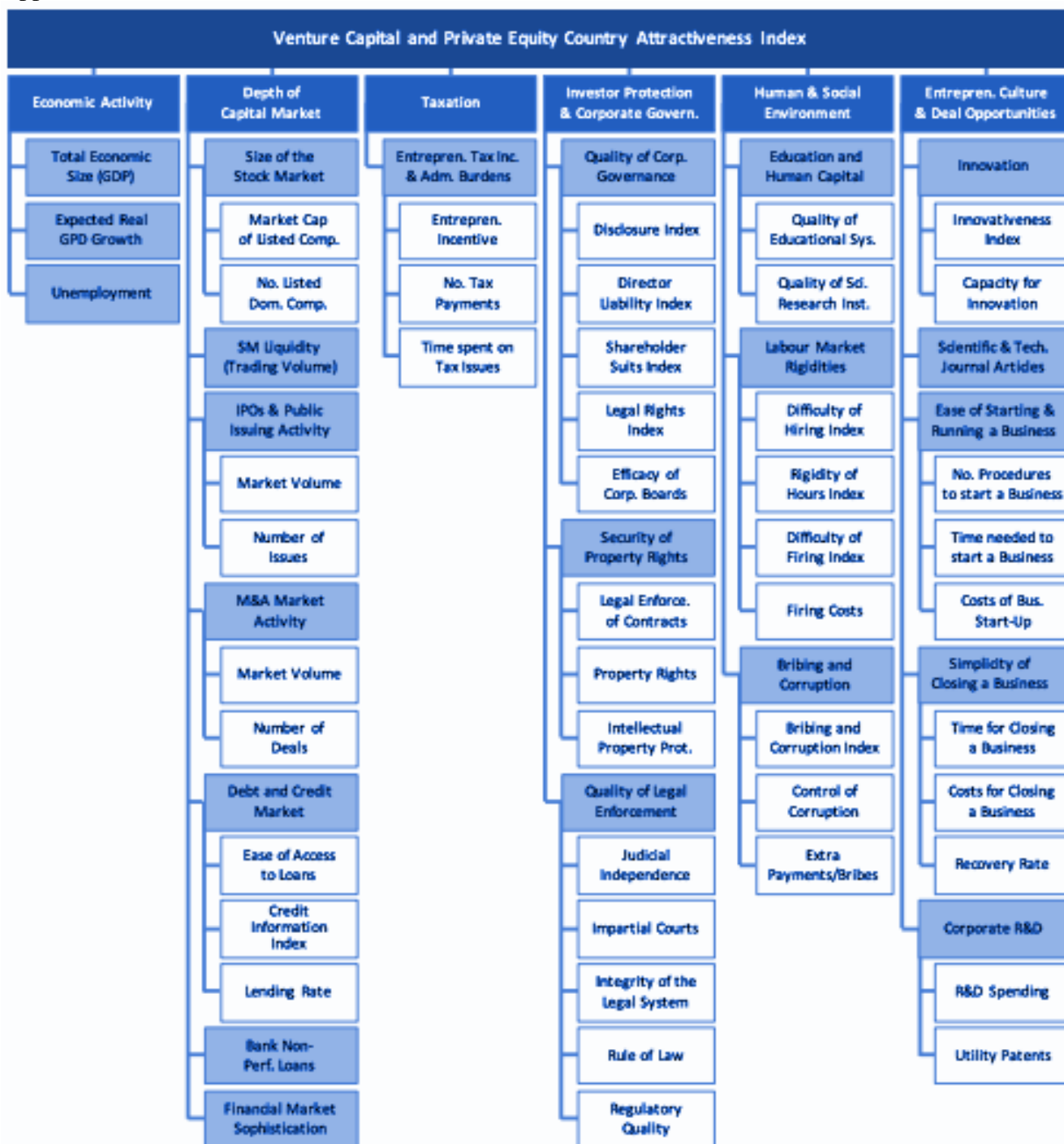
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Appendix 1 : Source : Groh et al , 2016



**Exhibit 1: VC/PE Country Attractiveness Index – construction scheme**

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ID	Construct	VC/PE Index Weight	VC-only Index Weight	PE-only Index Weight
1	Economic Activity	13.60%	15.80%	18.80%
2	Depth of Capital Market	31.80%	21.10%	43.80%
3	Taxation	4.50%	5.30%	
4	Investor Protection & Corporate Governance	13.60%	15.80%	18.80%
5	Human & Social Environment	13.60%	15.80%	12.50%
6	Entrepreneurial Culture & Deal Opportunities	22.70%	26.30%	6.30%

**Table 1 : Weights of the VC/PE index**

cronbach's alpha coefficient 
$$\alpha = \frac{N \cdot \bar{r}}{1 + (N-1) \cdot \bar{r}}$$

where n = number of the components of a construct  
r = mean correlation of the items.

The cronbach's alpha coefficient increases with the number of sub-indicators and with the correlation of each tuple. The Cronbach Alpha will provide information if our selected data is adequate to express the six key drivers, and if it is appropriate to aggregate the six key drivers to the overall index. Additionally, we use Cronbach's Alpha for the determination of the optimal data set when we calculate the tight index as a robustness check.

ID	Construct	Cronbach's alpha
1	Economic Activity	0.553
2	Depth of Capital Market	0.729
3	Taxation	-
4	Investor Protection & Corporate Governance	-
5	Human & Social Environment	0.75
6	Entrepreneurial Culture & Deal Opportunities	0.785

**Table 2 : cronbach's alpha**

Region	Index Rank	Index Score	1 Economic activity	2 Depth of capital market	3 Taxation	4 Investor protection and corporate governance	5 Human and social environment	6 Entrepreneurial culture and deal opportunities
North America	1	98.0	96.8	97.1	101.9	102.2	100.4	95.2
Australasia	2	90.8	90.2	82.4	107.2	107.7	101.2	85.5
Western Europe	3	80.5	84.1	70.6	111.7	87.7	86.2	80.6
Asia	4	70.0	93.2	65.0	93.6	69.5	61.6	66.8
Middle East	5	63.8	84.8	57.6	92.9	66.5	68.2	54.1
Eastern Europe	6	58.8	80.7	44.8	99.6	64.9	60.3	59.6
Latin America	7	54.5	81.7	48.4	87.2	55.0	46.8	50.1
Africa	8	44.3	76.0	29.2	86.0	56.2	47.2	42.1

**Table 3 : The Regional Venture Capital and Private Equity Attractiveness Landscape**  
Source : (Groh et al 2016)

Appendix 2 :

### Number and Percentage of Countries with Public Credit Registries and Private Credit Bureaus, by World Region, 2010

Region	Both public credit registry and private credit bureau		Private credit bureau only		Public credit registry only		Not available/negligible coverage
	Number	Percent	Number	Percent	Number	Percent	
Organisation for Economic Co-operation and Development (OECD)	7	26.9	17	65.4	2	7.7	0
Latin America and the Caribbean	13	72.2	3	16.7	2	11.1	3
South Asia	1	20.0	3	60.0	1	20.0	2
Europe and Central Asia	7	33.3	7	33.3	7	33.3	2
East Asia and Pacific	1	11.1	4	44.4	4	44.4	4
Middle East and North Africa	3	17.6	4	23.5	10	58.8	1
Africa	0	0.0	8	26.7	22	73.3	13
All regions	32	25.4	46	36.5	48	38.1	25

Source: World Bank 2011.

### Table 4 : Inadequate financial infrastructure

Scorecard scores explained :

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For coverage the scores are defined as -

Very Strong 5-6

Strong 3-4

Weak 1-2

Very Weak 0

For credit bureau the scores are defined as -

Very Strong indicator ranks are from 1-47th country

Strong indicator ranks are from 48-95th country

Weak indicator ranks from 96-141st country

Very Weak indicator ranks from 142-189th countries.

For Access, Soundness, Equity investors, venture capital score -

Very Strong is 1-37th countries,

Strong is 38-74 countries,

Weak is 75- 111th country and

Very Weak is 112-148th country.

For Financial freedom score -

Very Strong (100 – 90) : Minimal government control

Strong (60 – 80) : Limited government control

Weak (30 – 50) : Considerable government control

Very Weak (0 – 20) : Heavy government control.

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