Cow-Token – Financial Inclusion Blockchain Use Case

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Abstract

Local currency is a form of currency that complements the national currency. It can be used within a local community to purchase goods and services from participating merchants. It can be a fairly efficient and cost effective grassroot solution for financial inclusion for unbanked villagers. Issuers of Local currency can be a trusted village elder holding a part-time role of an informal financial intermediary. Private blockchain has characteristics that are akin to a local currency system. More importantly, it can make use of asset tokenization to improve the community's money circulation by converting illiquid assets into tokenized assets. For instance, a cow can be a primary source of income and store of value for microentrepreneurs in villages, and through tokenization, can be converted into a medium of exchange and used to supplement their working capital flow.

Acknowledgement

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1. Local Currency

The national currency systems that we are familiar with are not the only currency systems in existence. The term ‘Complementary currency’ is used to describe a currency designed to complement the use of national currency rather than replacing it. One of the most common form of complementary currency is known as ‘local currency’. Businesses in a local community sign up to accept the new currency in exchange for goods and services. Likewise, consumers exchange national dollars for denominations of the local currency. This form of complementary currency encourages money to remain in the region and supports small, local businesses, as well as fostering a closer supplier-consumer relationship.

One of the prime example of successful local currency scheme is the Swiss WIR[1] (“We” in German) economic circle cooperative. It is the longest surviving local currency which was founded in 1934 in Zurich as a response to the Great Depression. WIR currently does $6.7 billion in transaction volume per annum with a total of $3.1 billion in assets. The most famous local currency in recent years is the Brixton Pound in UK which was created originally as a thought experiment and features the photo of David Bowie on the note. Other examples include the Bristol Pounds and SoNantes, that were created as a response to austerity and recession while others like the Calgary Dollars and Talente grassroot currency system in the Austrian village of Langenegg, were created to promote tourism and local businesses.

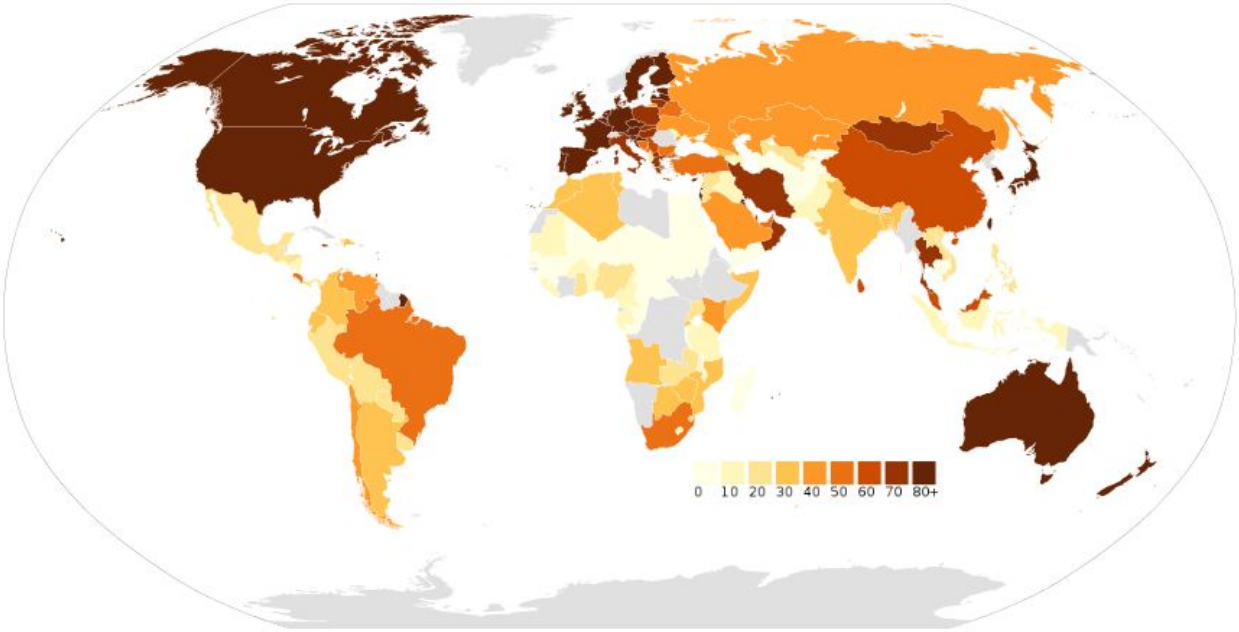
1.1 State of Financial Inclusion

Today, 2 billion adults worldwide live without a bank account - over a third of the world population. They depend on cash for survival in their daily activities. Financial inclusion refers to the delivery of financial services at affordable costs to sections of disadvantaged and low-income segments of society that do not own a bank account. According to the Center for Financial Services Innovation, a consumer is considered financially healthy when he or she:

1. Balances income and expenses
2. Builds and maintains reserves
3. Manages existing debts
4. Plans and prioritises spending
5. Manages and recovers from financial shocks
6. Uses an effective range of financial tools

Without a bank account, these unbanked individuals are considered financially unhealthy as they cannot carry out the six aforementioned activities.

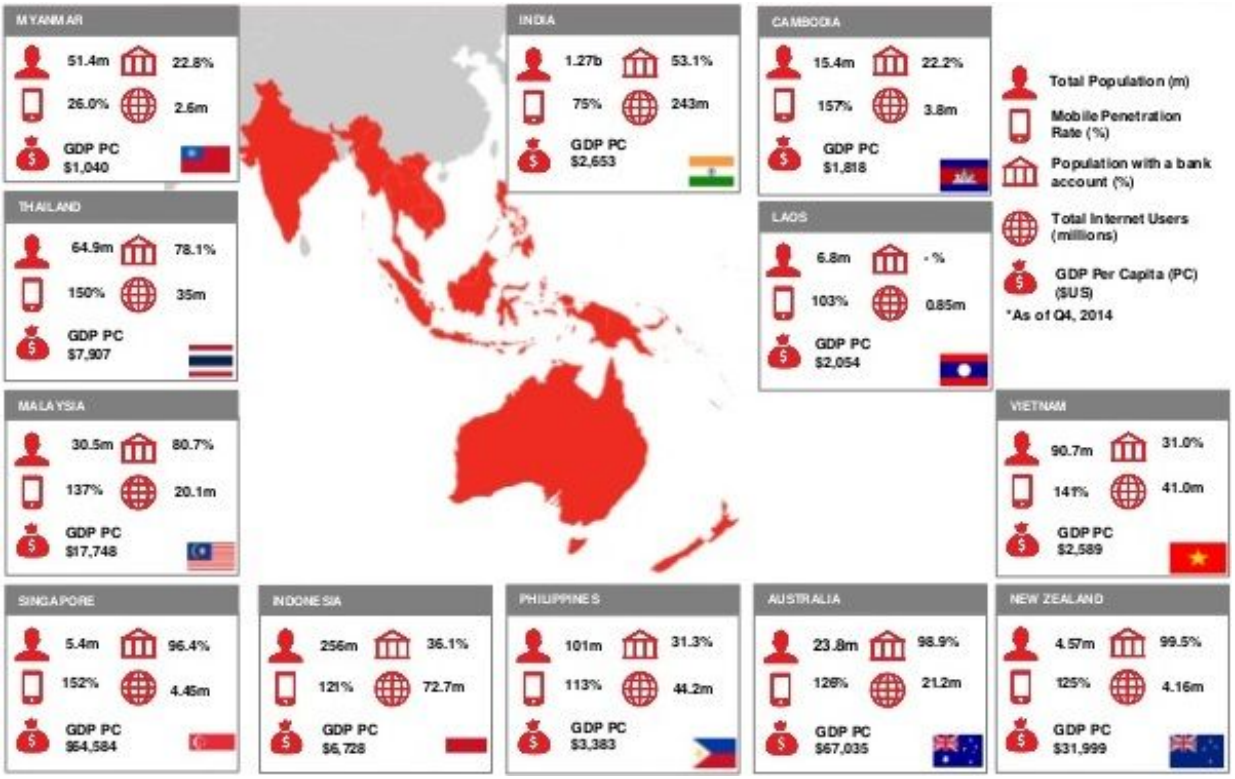
[1] http://www.resilience.org/stories/2016-09-28/wir-currency-reinventing-social-exchange/



Heatmap showing the different percentages of adults over 15 who have a bank account.
Source: http://www.centerforfinancialinclusion.org/fi2020/mapping-the-invisible-market

There is a large disparity in financial inclusion levels between countries with high performing economies and developing countries, i.e. 89% of adults in high income economies vs ~20% in sub-Saharan Africa. Even within a geographical region, there is a large disparity as well as due to socioeconomic factors. For example, in Africa, 55% of people with tertiary education have bank accounts, but this number drops to only 10% amongst adults with primary or no formal education. In the SEA region alone, 73% is unbanked[2] - that is approximately 440 million adults.

[2]https://home.kpmg.com/xx/en/home/insights/2016/04/fintech-opening-the-door-to-the-unbanked-and-underbanked-in-southeast-asia.html



Source: https://www.slideshare.net/SGFinTech/fin-tech-intro-to-financial-inclusionslideshare

It would seem that the world would remain in status quo, but innovative solutions have emerged in recent years to tackle this issue. A high mobile penetration in each of the countries with low financial inclusion has provided tantalising opportunities with new models of financial inclusion via mobile-enabled banking.

Thus, the rise in technological adoption can complement existing financial inclusion advancements such as local currencies and microfinancing. However, there must be a combination of financial literacy, infrastructure, and access to the right technology to facilitate financial inclusion.

1.2. Local Currency for Financial Inclusion

Local currencies are established to support local sustainability by incentivising spending at, and between, participants of the scheme. They may be used to purchase any good or service from participating retailers within a particular area, and can be recirculated by the retailer to purchase supplies (or given out as change items) achieving a so-called ***"local multiplier"*** effect. This has the effect of dis-intermediating large national chain that does not reinvest their profits back into the local ecosystem. To achieve this, purchases made using local currency from participants are typically cheaper as compared to traditional purchases with national currency. Unbanked communities unable to get formal loans without credit history can benefit from informal access to

microcredit facilities though the use of local currencies and spending it with participating merchants.

1.3. Local Currency mainly as Medium of Exchange

It is important to note that local currencies are different from central bank money[3]. The three key functions of money are:

- Medium of exchange (for making payments)
- Store of value (for retention of value)
- Unit of account (for measurement of price)

Local currencies generally exist mainly as a medium of exchange[4] and is particularly true in the unbanked developing countries. For instance, pre-paid mobile-airtime minutes can be transferred between phones and exchanged for cash or bartered for goods.

2. Electronic Local Currency

The digital form of local currencies does not have the associated printing and cash handling cost but is very difficult to achieve ubiquity. Such systems usually exists as a large scale centralised closed-loop payment systems that can take advantage of the economy of scale as well as financial resources enough to put up with the high investment outlay for its construction. However, the success of such larges scale financial systems depends largely on the market and regulatory conditions for adoption to take place.

[3] http://www.bankofengland.co.uk/publications/Documents/quarterlybulletin/2013/qb1304prereleasebanknotes.pdf
[4] http://www.appropriate-economics.org/materials/overview_of_Parallel_Local_and_Community_Currencies.pdf

2.1. The LASIC Principle

According to the LASIC principle[5] by Dr David Lee Kuo Chuen, there are five important attributes that contribute to the success of financial services innovation. These interdependent attributes are:

1. **L**ow profit margin - Low profit margin implies a low cost of adoption for consumers. Having a low cost of adoption expands the consumer base rapidly. Once a critical mass is achieved, monetization via indirect channels such as advertising and analytics becomes viable. In addition, sustainable profitability is achieved at scale at low margins and low marginal costs. Retention of users will enable economies of scale and increase switching cost. Consumers benefit more when the population of users increases.
2. **A**sset light - The ability to integrate a solution to an existing infrastructure without additional overheads and low marginal costs. In addition, the business model must be innovative and scalable.
3. **S**calable - As mentioned in the point on "Low Profit Margin", it is crucial for the solution to be scalable without compromising efficiency. Shifting business from offline to online enables ease of scaling.
4. **I**nnovative - The solution should be innovative, i.e. provide timely transformation in a user's journey in getting a job done, e.g., transfer money using a physical storefront versus using a mobile phone. Innovation can be revolved around the increasingly widespread usage of mobile technology and the internet services.
5. **C**ompliance easy - Regulations and innovation are two sides of the same coin. While regulations are required for consumer protection, over-regulation stifles innovation. Conversely, innovation-friendly regulations helps the solution scale faster with added support and resources like grants. This enables a business to lower capital requirement by leveraging on less resources and man hours spent on compliance activities.

2.2. M-PESA and bKash

M-PESA is the most commonly used success story for financial inclusion that was originally launched in Kenya at 2007 by Vodafone for Safaricom and Vodacom. M-PESA's success in Kenya was largely driven by the dominance of a single telco player with almost complete lack of financial infrastructure. In addition, Kenya had a favorable regulatory environment that recognised the practicality and utility of M-PESA. Another success story for electronic local currency is bKash, launched in Bangladesh in 2011 by bKash Limited, a subsidiary of BRAC Bank. Even though bKash Limited is a subsidiary of a bank, it enjoyed autonomy and operated independently of BRAC Bank. Without this regulatory opposition, bKash scaled rapidly and gained significant traction.

[5]https://skbi.smu.edu.sg/sites/default/files/skbife/research_papers/Emergence%20of%20FinTech%20and%20the%20LASIC%20Principles.pdf

While these two products seem similar, in that they both thrived in an environment where there is little opposition, the distribution of products are different. M-PESA was launched by a telecom company to leverage existing distribution channels and subscribers whereas bKash approached the market as an independent entity and was not confined to any mobile network operator.

Efforts to bring M-PESA and bKash out of their respective countries have been met with failure. M-PESA failed to gain popularity in Kenya's neighbouring, Tanzania, despite Tanzania having the same demographics and market conditions. Similarly, bKash has not been successful outside of Bangladesh's borders. The aforementioned factors are incredibly restrictive, and the success of electronic currencies cannot be replicated in other unbanked developing countries for now. Conditions that follow the LASIC principle must be met first before success can follow.

2.3 The 4D's of Digitalization, Disintermediation, Democratization and Decentralization.[6]

Digital innovation revolutionized the production function with emphasis on different factors. We are in the 4th industrial revolution where data and capital raising ability are crucial aspects valuing more so than land, labour and capital. The concept of 4D's underlines the importance of a shift towards a digital economy.

1. Digitization- Digitization is a process of harnessing digital technology to innovate. One example of digitalization is such as the advent of Smart phone. Through digitalization, data sets and sample points can be identified , verified and assigned using bits and bytes translating to alpha numeric representation in a virtual network on the cloud. This provides a platform to trade previously market-less objects through means of monetization.
2. Disintermediation- A process to rid middleman and to deal directly to facilitate peer to peer (P2P) transaction. Disintermediation allows greater flexibility and independence in trading.
3. Democratization-Through democratization, technology and services are now accessible to the underserved and unserved.
4. Decentralization- The decentralized nature of blockchain system allows decision to be made without centralized control or processing. However so , the degree to which connectivity or connectedness between peers are important aspect of decentralization. Highly connected system are highly favourable. In a decentralised state, this leads to growth and distribution.

These are characteristics that are well manifested in blockchain technologies.

[6] https://www.marketplace.org/2016/01/07/business/shine-digital-currency-bitcoin-boulevard

3. Blockchain Local Currency

Because blockchains are designed fundamentally as a decentralized technology for grassroots purpose, it is more agile to deploy in pockets of local communities in meeting the local currencies objectives and serving the unbanked financial inclusion needs. However, public cryptocurrency have not been able to take off successfully for local currency use cases.

- The bitcoin cryptocurrency was prime example of early days local cryptocurrency. At the peak of its popularity in 2014, Bitcoin has been used as a local currency in some countries[7] but it is unsustainable as a currency due to its volatile nature and is more suitable as an investment asset[8].
- Auroracoin was Iceland's local cryptocurrency that was created as a response to the country's strict capital controls imposed after the collapse of the country's financial system in 2008. It has once reached more than half a billion dollars total market capitalization, larger than more established altcoins like Litecoin and enough to pose a threat to Iceland's political system[9]. After enjoying a short stint of local popularity, Auroracoin plagued with both technical and forking issues and subsequently dropped from public use.
- There are examples of cryptocurrencies being tied to the value of USD. For instance, Tether(runs on Bitcoin) is pegged to USD and backed by USD reserves. BitUSD(runs on BitShare) is pegged to US dollar but uses forward currency contracts collateralised with the cryptocurrency BTS instead of actual USD reserves.

These examples relied on the use of public blockchains for the implementation of local currency which creates some practicality issues.

[7] https://www.marketplace.org/2016/01/07/business/shine-digital-currency-bitcoin-boulevard
[8] http://www.businessinsider.com/merchants-arent-accepting-bitcoin-2017-7
[9] http://kernelmag.dailydot.com/issue-sections/features-issue-sections/11331/auroracoin-history-failure/

3.1 Systemic Risks of Blockchain Forks

Public blockchain's biggest strength as a decentralized trustless network is also its biggest weakness. While removing single-point-of-failure risk associated with a trusted centralized party, it has also introduced systemic risks that are hard to fix without majority supporters' consensus. Forks[10] can occur from two different events.

- An accidental fork occurs if coin updates are not truly compatible. People using different versions of the software create two different ledgers–one from the older version, and one from the newer version. In this circumstance, the coin developer must rapidly eliminate the bugs causing the incompatibilities and decide how to merge the different blockchains.
- A hard fork is generated when the cryptocurrency's developers decide that changes must be made to the programming of the coin that will create incompatibilities between the older and newer version. When the changes are made, all users of that coin must be willing to update all applications to continue to use that coin type correctly.

When two different blockchains exist, only one can ultimately be correct. Thus, coin transactions found on the "wrong" blockchain could ultimately be lost. In theory if a fork is not fixed, this would cause a complete incompatibility and two different versions of the coin. The value of a permanently forked cryptocurrency would rapidly become worthless. When such an event occurs, it is very unlikely that unsophisticated local currency users will understand the risk nor legal implications arising from the loss of funds in using it for their business activities.

3.2 Price Volatility

Volatility in cryptocurrencies can be observed by referencing their prices in major crypto market exchanges of the world such as Poloniex or for specific cryptocurrency such as CoinDesk Bitcoin Price Index. It is not uncommon to see wild fluctuations in overnight cryptocurrency prices. For instance, Bitcoin's price dropped overnight for about 22% in January 2017 influenced by the strengthening of Chinese Yuan and traders' profit taking. The market cap of digital currencies also increased around 50% to $91 billion in a matter of one week in May 2017. It is also worth noting that the looming threat of a split in the cryptocurrency because of forks can have much influence on cryptocurrency prices as can be seen in bitcoin[11] as well as Ethereum[12]. Ethereum experienced a dramatic flash crash by 96% after the ICO of a new crypto-asset called "Status" clogged up the system. Due to this volatility, native cryptocurrencies of public blockchains cannot be used directly as a unit of account for the pricing of goods and services.

[10] http://www.coindesk.com/short-guide-bitcoin-forks-explained
[11] https://qz.com/937312/bitcoin-btc-is-tearing-itself-apart-again-and-its-price-is-yo-yoing/
[12] http://www.coindesk.com/ether-price-fluctuating-ethereum-fork-concerns/

3.3 Scalability Issues

The scalability problems associated with Bitcoin have been a subject of ongoing debate for a very long time. In a nutshell, the scalability problem is due to the protocol's 1MB hard cap being imposed on the block size by the protocol. The stalemate arises from the global community's inability to come to an agreement on the approach in resolving this limit without impacting the other parties' vested interests.

Developers would like to increase it (SegWit) because it can clear up some technical debts that free up the network for future enhancements (e.g., Lightning) but without impacting the overall network security. Users would like to increase it to transact with faster confirmation and to properly conduct businesses. Miners which controls the majority of the network are not in favor because it impacts their profit margin but everyone depends on them to secure the network. This impasse caused staunch supporters to defect to other public cryptocurrencies such as Ethereum.

The benefits of having a fully decentralized trustless network has also become its weakest link. Ethereum -once touted as the platform designed to withstand the kind of scalability problems that plagues Bitcoin - are not spared from scalability issues as demonstrated in its handling of heavy traffic as a result of recent ICOs[13]. Scalability issue is not just limited to the network itself but even the world's largest exchanges are unable to keep up with the load[14]. There is no silver bullet at this point to address the scalability problem. The solutions are generally moving towards the direction of using off-chain micropayment channels (eg. Lightning, Raiden), using pegged sidechains and merged mining (Rootstock) and substituting the mining community's influence via proof-of-stake style consensus protocols.

3.4 Slow confirmation time

The term transactions per second (TPS) is a metric used to define the speed of payment throughput. Bitcoin can process on average 7 TPS as compared to Paypals 115 TPS and VISA's on average 2000 TPS. This speed is largely derived from the hard cap imposed on Bitcoin's block size of 1MB since a block is only created roughly every 10 minutes and each transaction size is around 0.25Kb. This is directly related to the earlier point on scalability since the increase in block size can result in an increase in throughput for Bitcoin. However, confirmation time is just an average number, the confirmation time can be severely prolonged by any extraordinary event that results in congestion on the network. It is not uncommon for transactions to be pending for hours on both Bitcoin and Ethereum.

[13] https://www.dashforcenews.com/ico-mania-grinds-ethereum-halt-scaling-issues-not-limited-bitcoin/
[14] https://techcrunch.com/2017/05/25/coinbase-outage-unprecedented-bitcoin-interest/

3.5 Mining Fees

The way transactions are confirmed on the blockchain depends on miner's validation and submission. Miners expect a fee to be given as a reward for this service. With the phenomenal rise in awareness and demand for public cryptocurrency usage, the mining fees will increase as long as users are willing to pay for it. Mining fees have increased 1289% in 2017 since March 2015 on Bitcoin network[15]. A transaction is on average 250 bytes in size and for 100 satoshi per byte, the cost of transaction is 25000 satoshi and about $0.75 at the time of this writing. Even at this rate, it takes between 5 minutes to 3 hours to receive 1 confirmation.

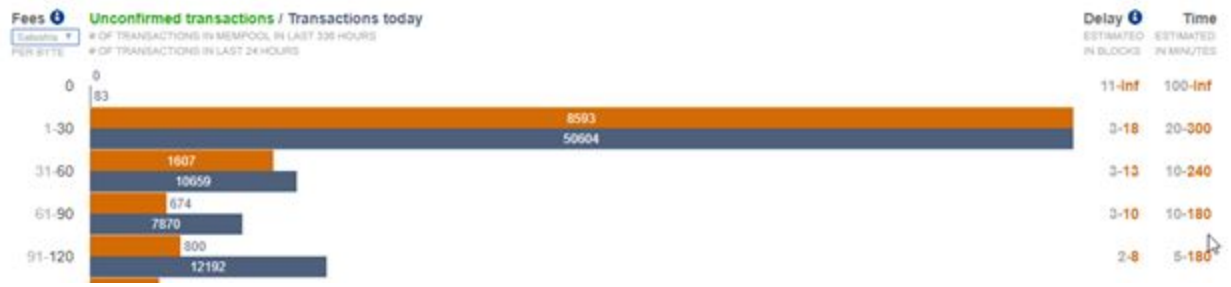


Figure 1- https://bitcoinfees.21.co/ as of July 2017

On Ethereum network, the average transaction fee peaked at US$2.5 and is above US$0.5 since May 2017.

Figure 2- https://bitinfocharts.com

[15] https://news.bitcoin.com/bitcoin-transaction-fees-1200-past-two-years/

4. Implementing Local Currency With Private Blockchain

To address this problem, we propose the use of private blockchains for the implementation of local cryptocurrencies.

4.1 What are private blockchains?

The term “blockchain” originally refers to the underlying technology used in implementing the Bitcoin protocol and network based on a paper published by Satoshi Nakamoto in 2008. The present-day use of this term generally refers, in a broad stroke, to a myriad of nascent distributed ledger technologies that are either associated with or evolved from the invention of Bitcoin. In practice, all blockchains can be classified as either public (permission-less) or private (permissioned). However, there is very little in common between the two worlds besides having the same technical lineage. We are generally more familiar with the characteristics of public blockchains. Public blockchains, such as Bitcoin and Ethereum, are designed to solve the double spending problem without a trusted third party and solving the byzantine general problem in a very harsh environment where approvals and authentications are not required when operating across a global asynchronous network. On the other hand, private blockchains are designed to operate in a more sanitized environment.

4.2 How are private blockchains different from public blockchains?

Generally speaking, private blockchain differs from public blockchain due to its use of authentication and permission to constraint the number of participating members, resulting in a more centralised user-base and controlled activities. Unlike public blockchain that is designed for peer-to-peer, private blockchains is designed for organisation-to-organisation transactions. Each organisation can centrally managed its own organisational and hierarchical role structure. Entities on private blockchain may require legally verifiable identities in order for members to transact. This strong reliance on identity and accountability is required for businesses to be conducted safely and legally in the real-world. Nodes are constrained by permissions and generally do not require the use of any network-derived incentives such as cryptocurrency found on public blockchains in driving its security.

4.2 How are private blockchains different from traditional databases?

In fact, in terms of use-cases, private blockchains are more similar to traditional databases than public blockchains. The main difference is that traditional databases, including distributed databases, are architecturally designed for centralised administrations. Therefore, private blockchains can be described as a new form of database that is more effective in providing shared control and ownership across organisational boundaries.

4.3 Using Local Blockchains for Local Currency In Financial Inclusion

Private blockchains can be further reclassified as consortium blockchains or as full private blockchains. The creator of Ethereum, Vitalik Buterin, has given a good comparison between the two - "So far there has been little emphasis on the distinction between consortium blockchains and fully private blockchains, although it is important: the former provides a hybrid between the 'low-trust' provided by public blockchains and the 'single highly-trusted entity' model of private blockchains, whereas the latter can be more accurately described as a traditional centralized system with a degree of cryptographic auditability attached". The private blockchains by the latter definition are typically used primarily for intra-organisational purpose or grassroot business communities. To state clearly on the distinction between consortium blockchain and full private blockchain, this paper will refer to a full private blockchain simply as a *local blockchain*.

Local blockchain can be a more suitable architecture for implementing local currency as they are more compatible in nature. The needs of the local blockchain is driven by local business purposes and has to be safeguarded against volatile price fluctuation in public cryptocurrency prices and mining fees. Local community must also be safeguarded against possible public blockchain forks which they neither have the sophistication nor technology know-how to mitigate. As the blockchain parameters are defined locally, the consensus protocols can run more efficiently with better scalability and performance throughputs. Software upgrades can be implemented a lot more efficiently within a small community.

When operating under the conditions of LASIC, local blockchain is better geared to support light-weight financial applications over traditional centralised databases[16]. The biggest risk involved is exposure to attack on the transactions ledger that can result in double spend or forgery. The biggest threat usually comes from insider access to the system. Another problem associated with centralised database is the exposure to single-point-of-failure risk due to system failure. To mitigate against these risk will incur high cost on infrastructure security and redundancy, human resources and stringent internal processes to maintain data integrity. This is not a practical solution for unsophisticated owners. Blockchain provides a more cost effective way to address this by leveraging on built-in features like multi-signature and relatively immutable transaction entries.

Local Currency can be implemented on the blockchain by the issuance of digital assets backed by national currency called Local Currency Tokens. Local Currency Tokens can be removed from circulation by sending it to a blockchain burn address when the underlying national currency is withdrawn.

[16] https://www.multichain.com/blog/2016/05/four-genuine-blockchain-use-cases/

4.4 Risks and Mitigations

- **Centralisation risks**

  Unbanked communities are generally close-knit and know each other in the community. Hence there exists an implicit social pressure to act responsibly and in good faith in respect of satisfactory performance of a good or service, and sound repayment conduct. The need for a 100 per cent decentralized trustless environment is then not an issue for contention.

- **Liquidity and Adoptions**

  Effective incentive models can be designed to encourage the adoption of local currency tokens.

  a. Demurrage

  Demurrage is the practice of reducing the value of currency in proportion to the time it is held, rather than spent. The “peanuts” LETS currency in Chiba Prefecture in Japan charges a 1% fee per month on currency that is not used. Demurrage encourages people to keep circulating the currency so as to avoid the loss of value. This is reportedly a significant factor in the success of Peanuts[17]. This can be implemented on the blockchain by setting a portion of the local currency to be invalidated using transaction time locks each time it is spent.

  b. Participant Rewards

  The use of the local blockchain can be encouraged by the issuance of rewards. For instance, the fees collected through the demurrage system can be re-distributed to other users of the community blockchain. To prevent the system from being abused by collusion of participants in making ghost transactions, rewards can be limited to only once time per demurrage cycle.

[17] https://ijccr.net/2012/05/23/complementary-currencies-in-japan-today-history-originality-and-relevance/

5. Financial Inclusion Use Case - Local Currency

The following section illustrates how a Local Blockchain can be applied to solving financial inclusion problems using local cryptocurrencies.

5.1. Local Currency Token (LCT) Blockchain

We shall begin by describing how a local currency system can be implemented via a local blockchain called Local Currency Token Blockchain (LCT). LCT represents the cryptocurrency implementation of the community's local currency that is fully backed by an equivalent amount of national currency. Let's assume that the national currency symbol is ABC. The convention used to denote the LCT specific for this purpose is then represented as LCT.ABC. A Local Community Owner ("Owner") can be defined as a key influencer in the local community ecosystem that can also be a provider of informal financial services. It can also be further assumed that the Owner is a bank account holder and can be seen as the eventual link that bridges the unbanked to formal financial services.

5.1.1 Funding

a. Owner deposit bank notes into a bank escrow account and issues equivalent amount of LCT (in practise this may involve joint-escrow account with multi-signature address for asset issuance). With the same assumption that the national currency symbol is ABC, the convention used to denote the equivalent LCT can be expressed as LCT.ABC. For instance, Local Community Owner deposits 100 ABC into the escrow account and is issued the corresponding 100 LCT.ABC cryptocurrency.

5.1.2 Usage

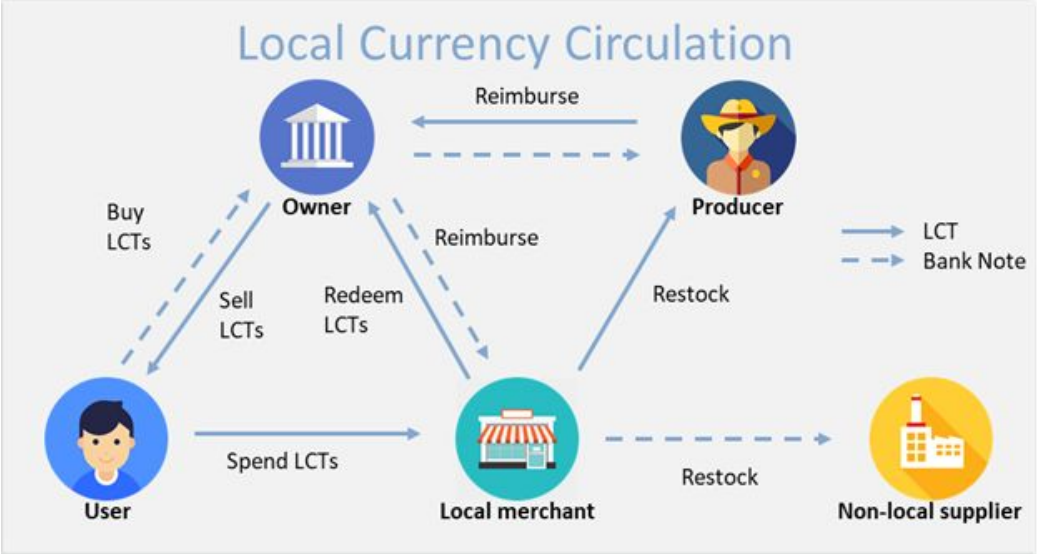
a. User exchange 10 ABC for 10 ICT.ABC with Owner.
b. User spend 10 ICT.ABC with Local Merchant for goods and services
c. Local Merchant spend 5 ICT.ABC with Supplier to replenish stock.

5.1.3 Claim and Redemption

a. Local Merchant will exchange 5 ICT.ABC with Owner for 5 ABC.
b. Local Supplier will exchange 5 ICT.ABC with Owner for 5 ABC.

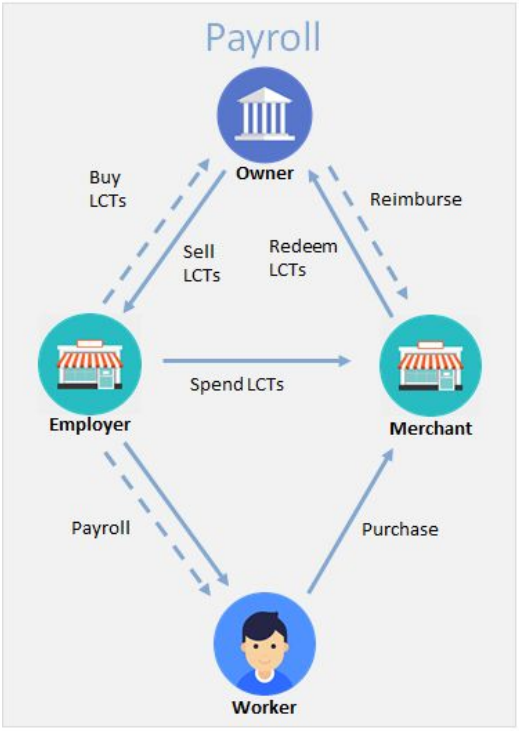
5.2 Micro-Entrepreneur/Rural Farmers

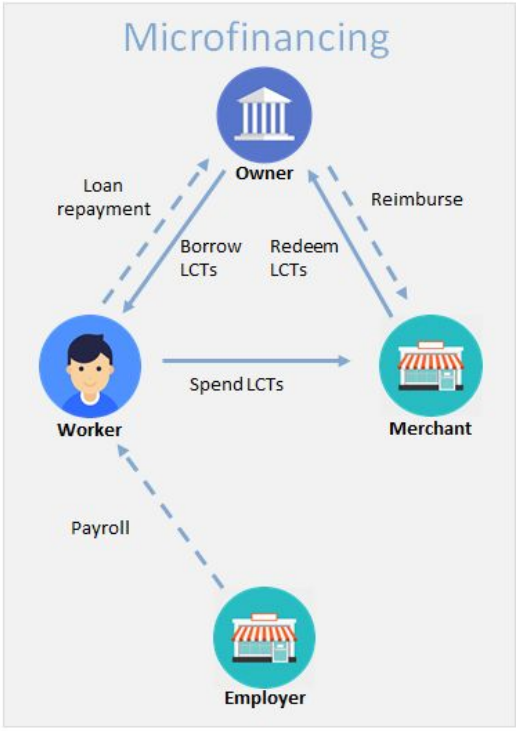
The same model is applicable to facilitate the direct buying and selling of goods and services from local producers such as rural farmers and the local merchants. Because trading can be conducted electronically using local currencies this enables better transparency in the movement of physical goods and money flow. In the existing situation where farmers are reliant on a middleman (or deliveryman) to sell and deliver their produce to the merchants, it is not uncommon for goods and cash pilferage to happen at this stage. Thus our proposed model ensures farmers are paid equitably and potentially helps achieve win-win outcomes for both farmer and merchant: Farmers can fetch a higher price from direct selling; and local merchants can purchase at a lower price from direct buying.



5.3 Payroll and Micro-Financing

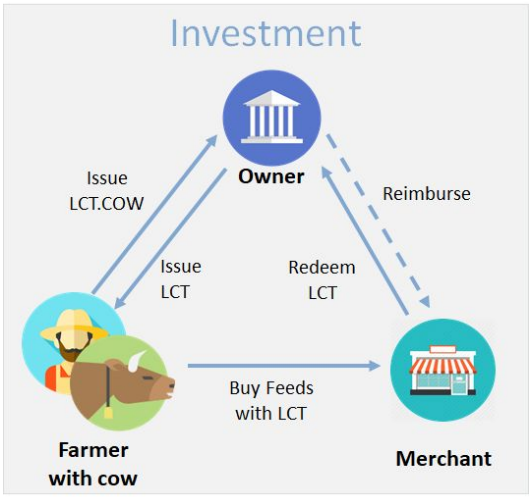
Besides the use of LCT for basic payment scenarios, LCT can be applied to more advanced scenarios such as payroll and micro-financing. Under the payroll scenario, employers can buy LCTs from the owner, which they can then use to pay their employees using either LCTs or banknotes. The employee can then spend them on merchants. Under the micro financing scenario, the worker can borrow LCTs from owners, which can then be spent on the merchants. After the worker is paid either with LCTs or bank notes, the worker can then repay his/her loan.



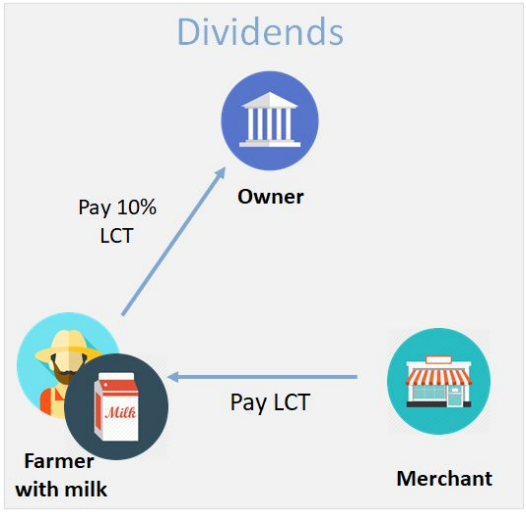


6. Financial Inclusion Use Case - Livestock Tokenization

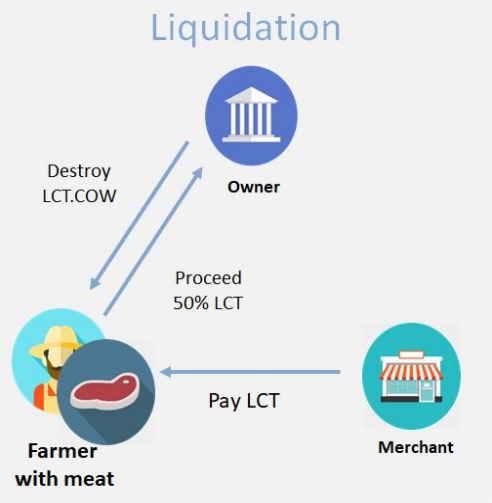
The implementation of LCT opens up a plethora of new avenues in providing innovative inclusive financing capabilities previously not available or difficult to implement using the traditional approach. Besides issuing local currency tokens, the Local Blockchain can be used to issue tokenized livestock assets - for instance, a Cow-Token. The concept of a Cow-Token is different from a local currency. It is actually a model that is similar to the securitization of livestocks into a form of convertible note. Here, Community Owner is the 'lender'.



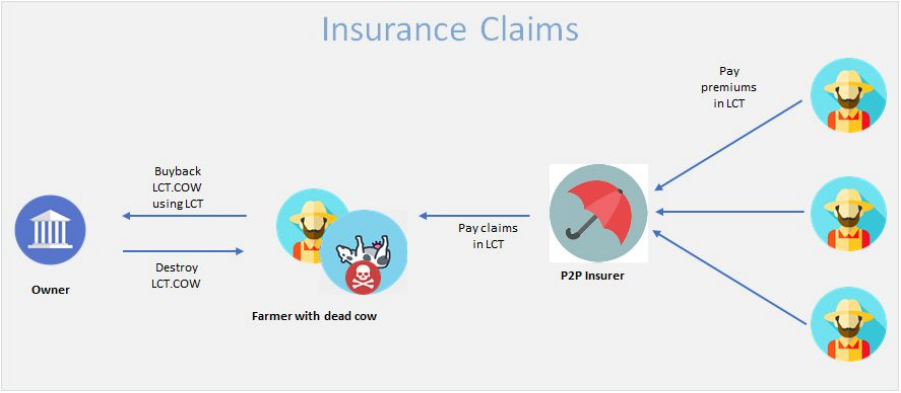
The farmer pledges the farming asset, ie. the cow and issues LCT.COW that is pegged to ABC and sold at a discount to the community owner in return for local currency LCT.ABC that is used to purchase farming supplies such as animal feeds. This is similar to issuing a discounted debt instrument. LCT.COW representing the face value can be sent to an address representing the cow and owned by the community owner. Depending on the agreed loan period and structure, regular loan repayments are in the form of LCT.ABC to the cow address.



The liquidation event is triggered when the cow is sold and the farmer will repay LCT.ABC equivalent to the face value LCT.COW to the lender. This can be implemented on the blockchain via a delivery-vs-payment approach using atomic asset exchange between LCT.ABC and LCT.COW to remove counterparty risks. In the scenario where a third-party micro-financier or P2P lender wishes to be the lender in this chain, liquidity will be pushed to the community owner to carry out the lending activity. In this way, lending and control of LCT.ABC remains with the community owner.



To mitigate the risk from loss due to the cow dying without salvageable value such as death from disease, innovative peer-to-peer (P2P) micro-insurance can be introduced. Members can pool together their premium paid in LCT.ABC to cover losses. Any residual funds, after accounting for claims and management expenses, will be returned to the members in LCT.ABC when a smaller than anticipated number of claims are filed. Meanwhile, re-insurance acts as a next tier of risk management in case of claims exceeding a predefined threshold. Using a P2P model encourages positive social dynamics within the insured group while lowering the insurance cost. Since every member know each other locally, there is a disincentive to file fraudulent or unnecessary claims and hence mitigating the risk of moral hazard.



7. Conclusion

According to World Bank, there are around 2 billion working-age adults globally (38%) that are excluded from formal financial services. It is not just the individuals but also businesses that are financially excluded of financing needs. Financial exclusion are due to the lack of banking outlets that are unwilling to serve the poor. On the other hand, a taboo in which the poor believes they are unable to get any benefits from banks. It is evident that between 2011 to 2014, a rise in 20% of individuals globally receive financial services (formally and informally).[18] Access to financial services is crucial as it creates sustainable existence and an opportunity to save for rainy days. Data proves that financial inclusion significantly improves human life in different ways. An example in Africa where household with basic saving and mobile money have been shown to have a more diverse diet and are better able to plan for their food expenses increasing standard of life.

The invention of blockchain has introduced new paradigms in revolutionising financial inclusion by combining the power of livestocks tokenization with local cryptocurrencies. In doing so, the value of livestocks that are traditionally locked up as illiquid asset can be unlocked to provide liquidity that can improve circulation of working capital flow within a local community. More importantly, the trading of asset tokens with members outside of the local community creates opportunity for fresh injection of capital into the ecosystem. With more capital in circulation within the community, all members in the community are financially empowered. The tokenization of a farmer's cow is just an illustration of what is possible. Besides livestock, tokenization can be expanded to other agricultural goods such as raw materials, e.g., palm trees, and farm products.

While local currency encourages *"local multiplier"* effect, bringing in fresh injection of external capital will require access to larger pool of liquidity. In our next whitepaper, we will introduce the concept of a permissioned interconnecting blockchain hub that enables crowdsourcing through public cryptocurrency and traditional inclusive banking services - we call it **Sentinel**.

[18] https://letstalkpayments.com/2-billion-people-dont-have-an-access-to-formal-financial-services/