REPORT | AUGUST 2017

Blockchains, Distributed Ledgers and Funds Transfer: An Overview

REDUCING POVERTY
THROUGH FINANCIAL SECTOR DEVELOPMENT

consult hyperion
securing tomorrow's transactions

fsdafrica

Key points

01

The volume of remittances is growing year by year but prices for international transfers are still relatively high. Blockchain and Distributed Ledger Technology (DLT) presents opportunities for new ways of performing funds transfers, payment settlement and regulatory oversight, due to its decentralised, replicated and transparent nature.

02

DLT can help to reduce the cost of remittances, increase speed of settlement, reduce settlement risk, decrease entry barriers for financial institutions, improve the interoperability of different financial instruments and enhance the regulatory frameworks that oversee funds transfers such as Know Your Customer (KYC) and Anti-Money Laundering (AML) processes.

03

There are two key ways in which these can be achieved: (i) the usage of public DLT in general, and Bitcoin in particular, as a financial instrument and (ii) use of the private DLT as a means to clear and settle obligations between different financial institutions either domestically or internationally.

04

Bitcoin, as all public DLT applications, is essentially a shared transactional database – in other words, a shared accounting system. The Bitcoin application (as some other cryptocurrencies) is focused in particular on value transfers and thus constitutes a publicly available payment system. There are issues associated with the scalability, volatility, governance and legal standing of public distributed ledgers.

05

The principal impediment to the use of cryptocurrencies in a peer-to-peer fashion as a means to transfer funds is the costs at the edge: due to severely limited access to cheap cryptocurrency-fiat exchanges (intermediaries), the costs (and effort) of buying and selling Bitcoins for remittance purposes may be simply too expensive.

06

In comparison with more traditional, centralised initiatives, the private DLT model for inter-organisational clearing and settlement could be considered more secure (less opportunity for systemic fraud), less costly to set up, and more scalable (easier to on-board organisations). Private DLT solutions could face less politically charged resistance than centralised Real Time Gross Settlement (RTGS) switches might do.

07

Accurate and detailed information on individuals is often reported as a key barrier to credit decision making by financial providers. DLT has the potential to act as a reliable ‘store’ of identity information available in near real-time and as a generator of dynamically changing identity attributes (such as creditworthiness).

08

However, this is not straightforward. Reliability comes from intrinsic DLT characteristics (such as amend-only transaction history across parties and cryptographically secured transactions), but not exclusively from them. To ensure trust and reliability, it is important that DLT solutions are developed in accordance with national laws and security standards, and take into consideration the views of all stakeholders.

Photos and graphic design: Kristina Just

Blockchains, Distributed Ledgers and Funds Transfer: An Overview

BY: SALOME PARULAVA

Acronyms

AML	Anti-Money Laundering
CDD	Customer Due Diligence
CFT	Combating the Financing of Terrorism
CGAP	Consultative Group to Assist the Poor
CICO	Cash-In/Cash-Out
FATF	Financial Action Task Force
ID&V	Identification and Verification
MFI	Microfinance Institution
MMO	Mobile Money Operator
DLT	Distributed Ledger Technology

Acknowledgements

"Blockchains, Distributed Ledgers and Funds Transfer: An Overview" was authored by Salome Parulava, Associate Consultant at Consult Hyperion. She would like to extend her gratitude to the U.K. Department for International Development (DFID) and Financial Sector Deepening Africa (FSD Africa) and to the following for assisting in compiling the report: Paul Makin, Iain Brougham, Joe Huxley, Fundi Ngundi and Martin Namasaka.

The views expressed in this report are those of the author, Consult Hyperion, and in no way entirely reflect those of FSD Africa.

Contents

List of Figures & Tables

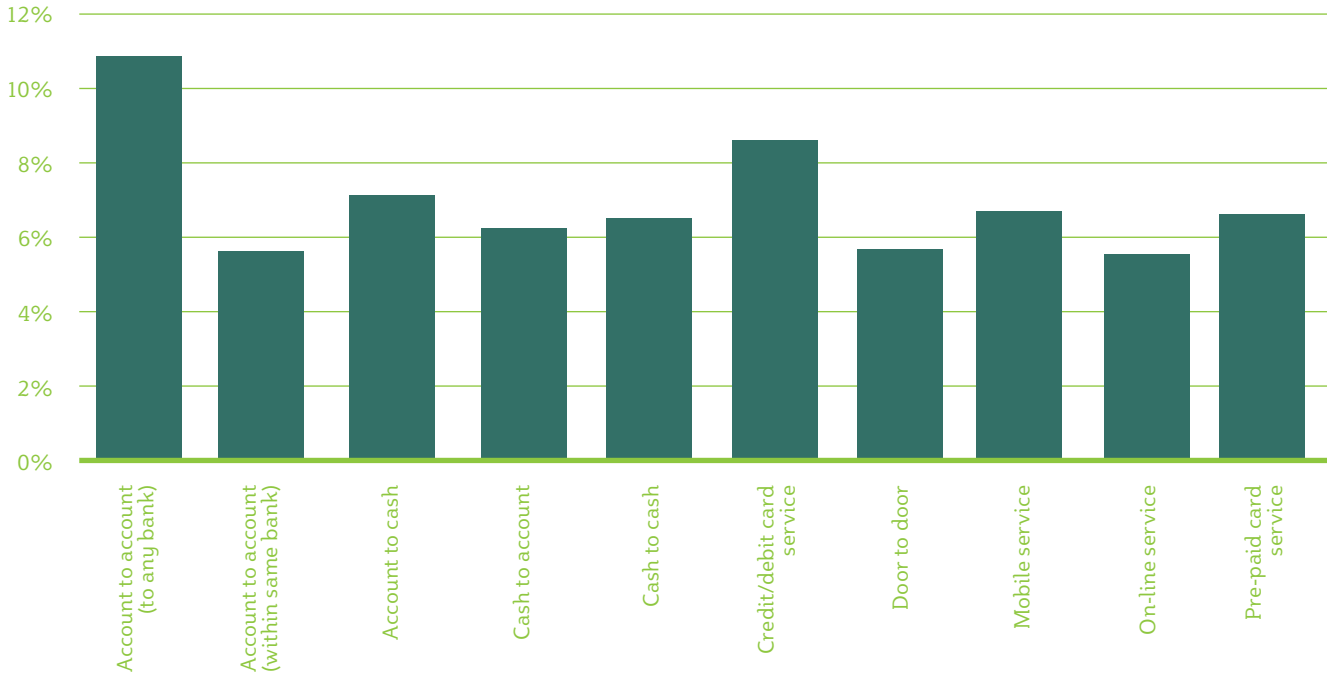
1. Introduction

1.1 Fund transfers: current situation

In the past decade, the financial services industry has developed significantly across the emerging markets. Since the introduction of mobile money schemes such as M-PESA, we have seen a steady stream of change towards more inclusive financial markets. Research[1] carried out by CGAP shows that outcomes of financial inclusion are directly linked with higher economic growth and better wellbeing. Nevertheless, many financial instruments and services remain unaffordable and inaccessible for major parts of the population in emerging economies.

The volume of remittances is growing year by year but prices for international transfers are still relatively high. According to the World Bank, the average global cost of sending remittances in the last quarter of 2015 was recorded at 7.37%, with commercial bank transfers (11.12%) being the most expensive means of remitting money and online services being the least expensive (5.57%).[2]

Figure 1: Average Cost of Remittances, by Product Type, 2015 (Source: The World Bank)



1.2 Intermediaries, problems they solve and instruments they use

The range of entities that can provide financial services, including fund transfers, are banks (state-owned and private), credit unions, cooperatives, microfinance institutions, near-banks,[3] MMOs, retailers, post services (including postbanks), and internet giants. Such institutions act as intermediaries between the senders of the funds and the beneficiaries (receivers), solving for them problems of communication (accessibility), logistics and interoperability, as well as reducing counterparty risk between parties.

For example, a bank could give a person in the UK an opportunity to send money to a person in Nigeria, thus solving communications and logistics problems for the sender and beneficiary (through a network of partners).

[1] http://www.cgap.org/about/faq/what-impact-financial-inclusion-efforts
[2] https://remittanceprices.worldbank.org/sites/default/files/rpw_report_december_2015.pdf
[3] Companies that provide front-row online banking services to customers and rely on traditional banks to be the backbone of the financial transactions of their customers. For example, Simple Finance Technology Corporation (US) (https://www.simple.com/)

The financial intermediaries also provide a way to convert British Pounds to Nigerian Naira and ensure the availability of the funds to the beneficiary in the forms of cash, bank deposit and mobile money (solving the interoperability problem). Finally, the sender and receiver do not necessarily need to trust each other in order to complete the transfer as the intermediary acts as a trusted third party with certain liabilities and dispute resolution authority (reducing counterparty risk).

In certain cases of fund transfers these issues (communication/accessibility, logistics, interoperability, reduction of counterparty risk) are likely to be quite costly for intermediaries to tackle and therefore, in order to ensure profits, prices for end customers are often correspondingly high. In many cases, the provision of financial services to certain population groups is even commercially irrational as the costs of doing business may outweigh the potential benefits from servicing new customers.

1.3 How Blockchain and Distributed Ledger Technology can help

In this paper we argue that there are two key ways in which Blockchain and, more broadly, Distributed Ledger Technology[4] can assist in the area of fund transfers in emerging markets:

- One approach is based on the usage of public distributed ledgers in general, and Bitcoin in particular, as a financial instrument and as a platform for cross-border, high-speed, low-cost value transfers for consumers, businesses and international agencies.
- Another approach considers the use of the private distributed ledgers as a means to clear and settle obligations between different financial institutions, either domestically or internationally.

To understand these opportunities, it is important to first explore in sufficient detail the components and characteristics of the technology in question.

[4] The concepts are explained in the following section

2. Technology Classification and Components

2.1 Bitcoin, cryptocurrency, Blockchain and Distributed Ledger Technology

2.1.1 Distributed Ledger Technology Architecture

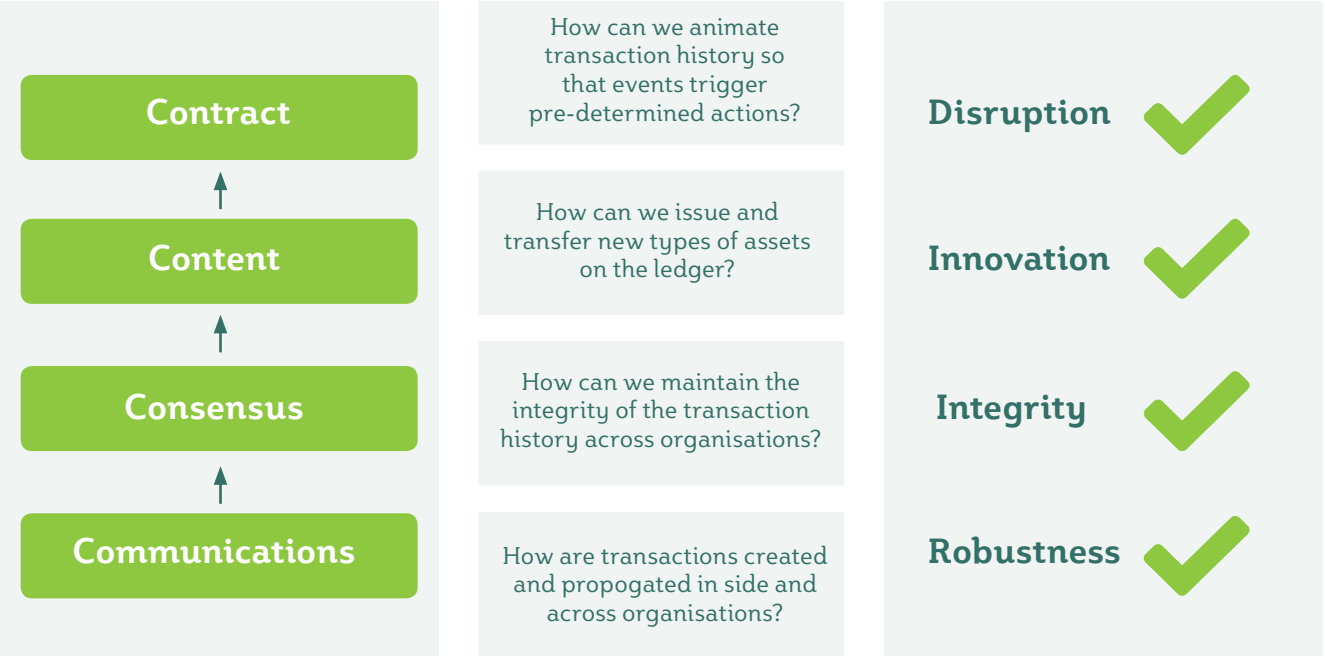
Blockchain technology in general, and the Bitcoin[5] Blockchain in particular, are instances of a wider concept – Distributed Ledger Technology (DLT). At the heart of DLT is the idea of replicating data and codes across individuals and organisations in such a way that dispute resolution is embedded and enforced by computer protocol.
The Economist puts it this way:

> "It offers a way for people who do not know or trust each other to create a record of who owns what; that will compel the assent of everyone concerned. It is a way of making and preserving truths."[6]

The key value-added characteristic of DLT is an unchangeable transaction history, backed by a transaction-executing protocol universally available across parties.

Distributed ledger architecture consists of four main layers: communications, consensus, contents and contracts. This is illustrated in Figure 2, which also highlights the impact and opportunity that each layer of DLT represents.

Figure 2: Distributed Ledger Technology Model



At the communications layer, distributed ledgers use consistent cryptographic rules to create transactions and propagate over peer-to-peer networks, which ensure the security and robustness of the system. The consensus layer is a mechanism to reach system-wide agreement over the things that are written into the ledger, i.e. the transaction history. Differences in the consensus layer across different implementations of DLT lead to very different kinds of distributed ledgers, and thus different ways of settling between individuals or doing business between organisations.[7] The contents layer records the ownership of assets, while the contracts layer (aka 'smart contracts') serves to add conditions to value transfers and enhanced business logic to the distributed ledger. The implementation choices on each of the architectural layers lead to a variety of distributed ledgers with different characteristics.

[5] Bitcoin is a decentralised digital currency that uses cryptography to secure transactions (cryptocurrency)
[6] http://www.economist.com/news/briefing/21677228-technology-behind-bitcoin-lets-people-who-do-not-know-or-trust-each-other-build-dependable
[7] For example in Bitcoin, the consensus layer is 'proof-of-work' protocol

It is important to understand the relationship between the terms 'Bitcoin', 'cryptocurrency', 'Blockchain' and 'DLT'. Bitcoin is a virtual cryptocurrency whereas Blockchain is a replicated shared database technology that underpins Bitcoin, and is itself a design solution for a 'public distributed ledger'. The most encompassing term is DLT.

2.2 DLT in fund transfers (public and private distributed ledgers)

As mentioned in the first chapter, the financial instruments that intermediary companies use for fund transfers are fiat currencies, in the forms of cash, bank deposits and electronic money. By contrast, a cryptocurrency (the most dominant instance of a public DLT) is a fundamentally new way to carry out value transfers over the internet which eliminates the need for intermediaries.

A cryptocurrency could be seen both as a platform (technology/distributed autonomous entity) that provides a public accounting service in place of institutional actors, and as a financial instrument itself (virtual currency) that in some circumstances may act as a medium of exchange, store of value and measurement of value. Cryptocurrencies in general, and Bitcoin in particular, can be a basis for a long-distance, high-speed, low-cost value transfer system.

Bitcoin, as all DLT applications, is essentially a shared transactional database – in other words, a shared accounting system. The Bitcoin application is focused in particular on value transfers and thus constitutes a publicly available payment system.

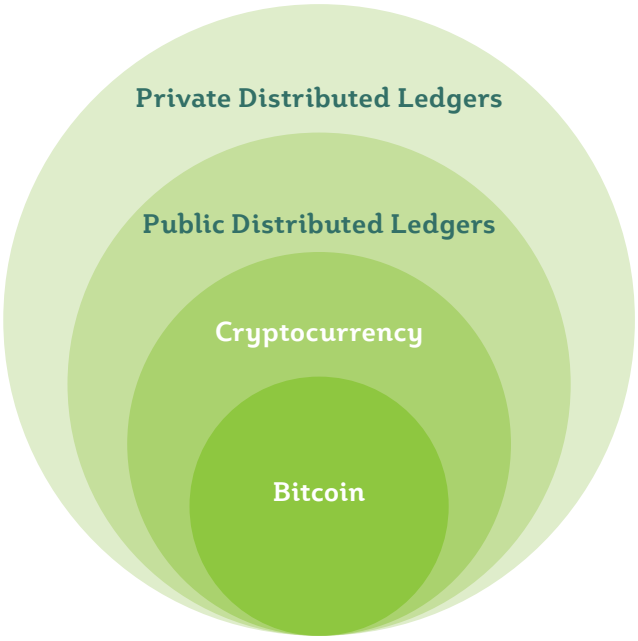
To administer digital value transfer in a decentralised manner, there are many technical challenges to be thought through. The key problem is to prevent digital value from being spent several times in absence of a trusted third party that maintains a centralised database ('double-spending' problem). If I can copy a photo and send it to two different people over the internet, how do I make sure I cannot copy a digital coin (say, Bitcoin) and send it to two different people?

To prevent 'double-spending', Bitcoin utilises a proof-of-work protocol (on its consensus layer). Proof-of-work, also referred to as 'mining', requires computational work to be done by anyone who attempts to update the ledger. It introduces economic incentives for genuine contributions to updating the Bitcoin's DLT (the Blockchain) and makes it too costly for any single actor to change the history of transactions if they wish to do so.

Such an incentivising scheme together with peer-to-peer communication protocols and strong cryptography works to produce a permissionless value transfer system. Such a system allows anyone to use it and does not require any form of permission, e.g. identification or licensing, in order to operate from the public DLT. This makes public distributed ledgers transparent, open, immutable, robust and pervasive.

Openness and pervasiveness play a significant role in adoption of Bitcoin and other public DLT. Nevertheless, there are issues associated with the performance, governance and legal standing of public distributed ledgers.

Figure 3: Hierarchies



From Consult Hyperion

Another example of DLT is private distributed ledgers. Private DLT requires all the participants to be permitted into the network by certain external governance rules. This means that participants are known to each other, legally identified and accountable for their actions. As there is a way for legal enforcement in such systems, the need for technological enforcement using energy-intensive proof-of-work protocols is no longer required.

Private DLT has potential to reduce some of the underlying costs of money transfers, and by doing so could contribute to more affordable as well as more scalable financial services. In particular, Private DLT are good at eliminating need in complex reconciliation processes, saving money on dispute resolution and in substituting certain paper-based processes.

Table 1, below, provides a comparison of public DLT (exemplified by Bitcoin) and a private DLT-based service.

Table 1: Comparison of Two Applications of DLT

	Public DLT application (Bitcoin)	Private Inter-Organisational DLT Application
Participants	Mostly individuals, but sometimes organisations	Organisations
Identities	Pseudonymous	Fully verified
Access to use	Open	Restricted to permitted actors
Transaction data transparency, verifiability and provenance	Transparent and verifiable. History of each Bitcoin can be traced to the chain of addresses that were in possession of it after the coin was created	Not necessarily transparent but verifiable by all participants. Chain of custody of each asset can be verified
Record of transactions	Unchangeable	Unchangeable, however: • Type 1: Can be deleted if consensus between participants is reached. • Type 2: Can be transparently deleted by master participant(s)
Data permanently recorded in transactions in the ledger	Bitcoin transactions (sender's address, receiver's address, currency volume) + additional data[8]	Transfers of any representation of existing asset Programming code to automatically execute conditional transfers + additional data

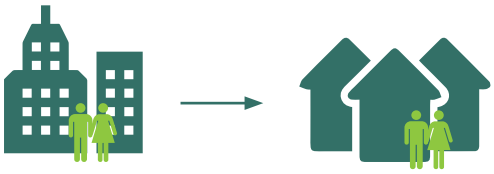
In general, applications of DLT can be categorised into value transfer applications, data integrity ('proof of existence') applications and smart contracts. The key applications in payments include: international payments and remittances, micropayments, settlement between financial service organisations (including banks, mobile money operators and MFIs), digital currencies, domestic payments, internet of things payments and identity management (KYC/CDD). It is important to note that, contrary to perceptions, DLT in general has great potential to enhance KYC and AML procedures. Set against these should be the principal concerns around the use of DLT: regulatory recognition and framing, interoperability and compatibility of different ledgers, market adoption and data privacy.

The wide variety of design choices around each layer of the DLT architecture enables a vast number of possible applications, each with distinctive characteristics. However, two types of architectural design are of most relevance for fund transfers in emerging markets: public distributed ledgers (Bitcoin in particular) and private inter-organisational distributed ledgers. Both relate in one way or another to the payment settlement process.

In the following chapters we will present a number of fund transfer applications based on these two key architectures of DLT.

[8] This could refer to anything from a simple reference note, file location or blinded ID data to a 'hashed' document of any length. The latter provides the opportunity to verify the state (or even existence) of a document at a certain historical point in time

3. Fund Transfer Models Based on Public Distributed Ledger Technologies



3.1 Remittances

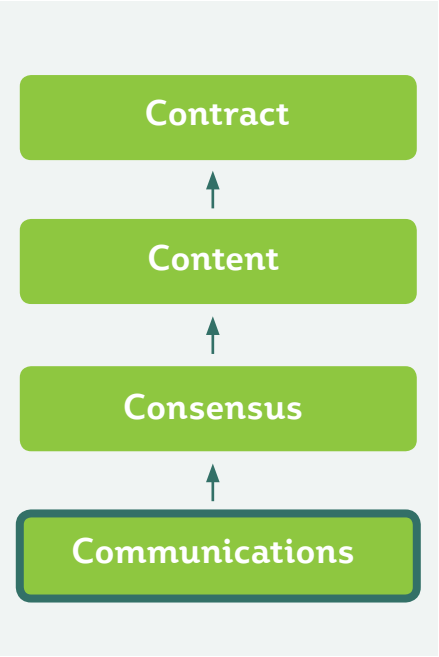
We will first explore the potential of public DLT and in particular Bitcoin (and other cryptocurrencies) in remittances.[9] It is useful to do so by examining the key 'send money home' use case.

Today, this can be done mainly by using traditional branch-based money transfer operators such as Western Union or MoneyGram and online solutions such as TransferWise or Azimo. All of these use national currencies as financial instruments, although in different forms. To assure faster service these companies have to carefully manage the capital available for distribution in each of the money-receiving locations, and employ a post-transaction, inter-currency reconciliation and settlement approach across multiple transactions in order to maximise efficiency. Naturally, they also have to comply with KYC and AML regulation in both the sending and receiving countries, and for this reason they have to share customer identity and behaviour data across the chain of partners.

3.1.1 Cryptocurrency as a public accounting system

Cryptocurrency technology has promise for emerging economies due to its potential to sidestep the costs of international payment settlement. The communications layer of DLT ensures security and universal availability of data because all transfers are protected with strong cryptographic techniques[10] and all data is broadcast to the entire network of participants. This means that a cryptocurrency on its own may serve as a public accounting system and some financially excluded members of society may choose to 'open an account' with an intermediary-free cryptocurrency platform rather than go through all the hurdles of registering with a bank (since many do not have sufficient identity documentation to be able to open a bank or mobile money account).

DLT Layered Architecture



In this regard, Bitcoin has some advantages over other instances of cryptocurrencies: (i) it is a working system, and is the most widely adopted cryptocurrency internationally; (ii) the Bitcoin market has a better liquidity (so Bitcoins can be more easily bought/sold for other assets, be it national currencies or other cryptocurrencies); and (iii) open-source Bitcoin software is available in different versions compatible with most popular computer systems. With such tools as the Raspberry Pi (a small, cheap computer that can be plugged into any TV set and which is able to support a Bitcoin wallet) now available, more and more people will have access to the benefits of open-source software.

When referring to this peer-to-peer way of conducting value transfer over the internet, Bitcoin technology is sometimes described as electronic cash. This term emphasises the pseudonymous nature of Bitcoin payments and the idea of digital data becoming a 'bearer' asset (like cash). When combined with the 'send money home' use case, such electronic cash can be used (to a limited degree) for commerce and microfinance.

[9] Public distributed ledgers predominantly are cryptocurrencies or use cryptocurrency technology as a crucial part of the system.
[10] Having said this, it is important to remember that advances in computing (e.g. quantum computing) may one day make the cryptography used in today's cryptocurrencies easy to crack. In this regard, cryptocurrencies are no different from any other technology or service that relies on cryptography.

Some small businesses may prefer to use Bitcoin-based peer-to-peer lending services (e.g. Bitbond[11]) because of lower entry barriers for services such as small repeatable loans.

The principal impediment to the use of Bitcoin in a peer-to-peer fashion as a means to transfer funds is the costs at the edge: due to severely limited access to cheap cryptocurrency-fiat exchanges (intermediaries), the costs (and effort) of buying and selling Bitcoins for remittance purposes may be simply too expensive. Although Bitcoin has a better liquidity in comparison to other cryptocurrencies, it is still insufficiently liquid in emerging economies due to their economic and institutional immaturity.

Other issues include:

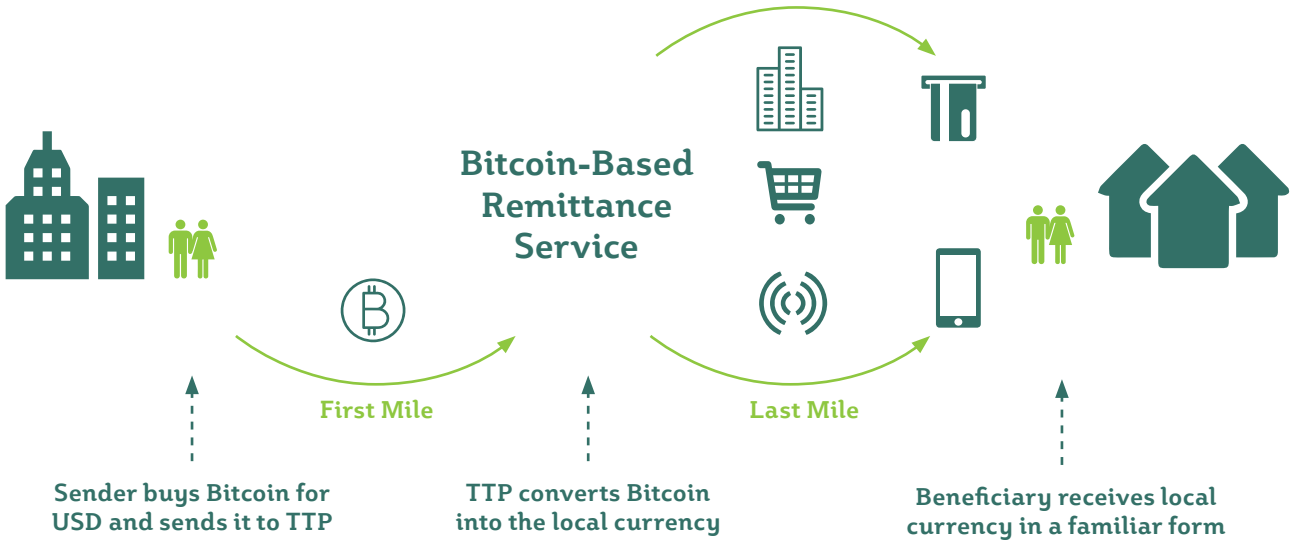
- **Scale:** Bitcoin's use is not yet sufficiently widespread to assure that Bitcoins can be easily spent on payments or used for peer-to-peer transfers. The necessity of computer or smartphone adoption and internet connectivity also serve to keep Bitcoin use cases at the margin.
- **Store of value:** due to the high volatility demonstrated in recent times,[12] the usage of Bitcoin for savings is problematic.
- **KYC and AML problems:** the pseudonymous nature of transactions and open, public access to the payment mechanism offered by Bitcoin create space for illicit activities that benefit from privacy, and give rise to reasonable concern among regulatory authorities.

3.1.2 Cryptocurrency as a 'pipe' for international transfers

Bitcoin (and other cryptocurrencies) can be seen as a publicly available 'pipe' for value transfers. As for any other pipe, Bitcoin can be used in a bundle with other pipe providers.

The model already used by several start-ups is generalised in Figure 4, below. In this model, the sender buys Bitcoin for USD (or any other available currency) and sends it to a Bitcoin-based remittance provider (e.g. BitPesa in Nigeria, Kenya, Uganda and Tanzania). The Bitcoin remittance provider then delivers money to the beneficiary using an international and local partnership network, including last mile[13] partners (who could be mobile money providers or bank branches, but also small retail shop networks).

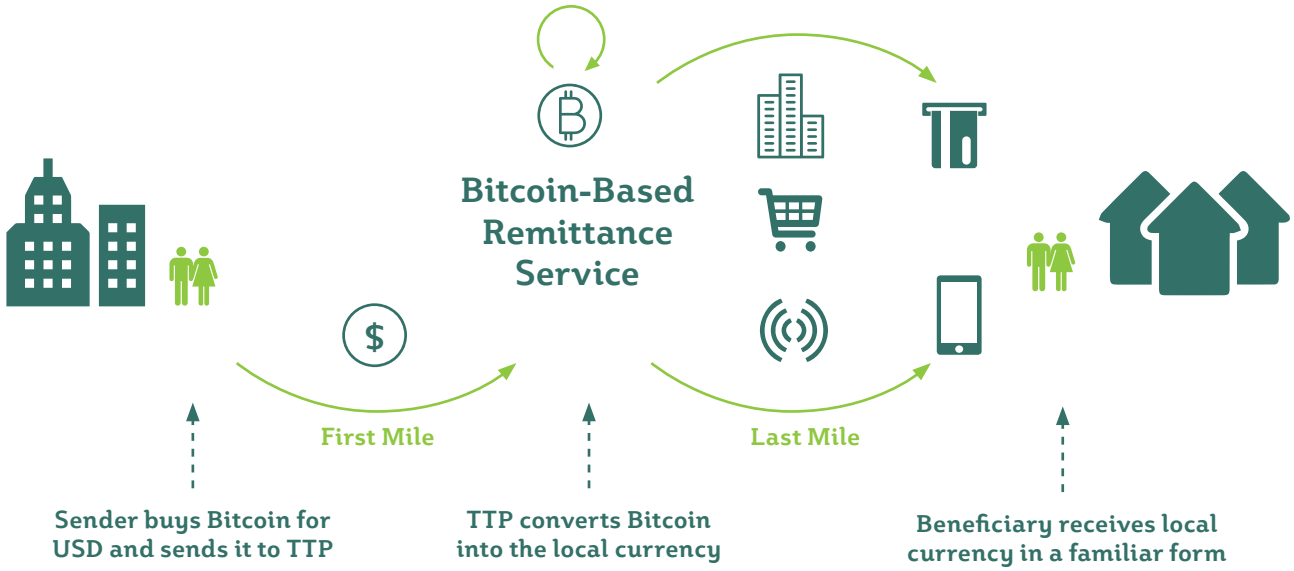
Figure 4: Third Party-Enabled Bitcoin-Based Remittance Model



Another business model for remittance providers (Figure 5) is where a Bitcoin transaction is used only to substitute the international part of the journey and effectively the usage of Bitcoin in the service is invisible to both the sender and beneficiary (for example, Rebit.ph[14] in the Philippines).

[11] https://www.bitbond.com
[12] See bitcoincharts.com/charts
[13] In this context, first mile refers to the funds in process, where a customer transfers funds to the remittance operator/money service business; the second mile refers to the international transfer of funds, including foreign exchange or the fiat currency/Bitcoin exchange; and the third, or last, mile refers to the delivery of the funds to the recipient in the currency they choose
[14] https://rebit.ph

Figure 5: Third Party-Enabled 'Invisible Bitcoin' Remittance Model

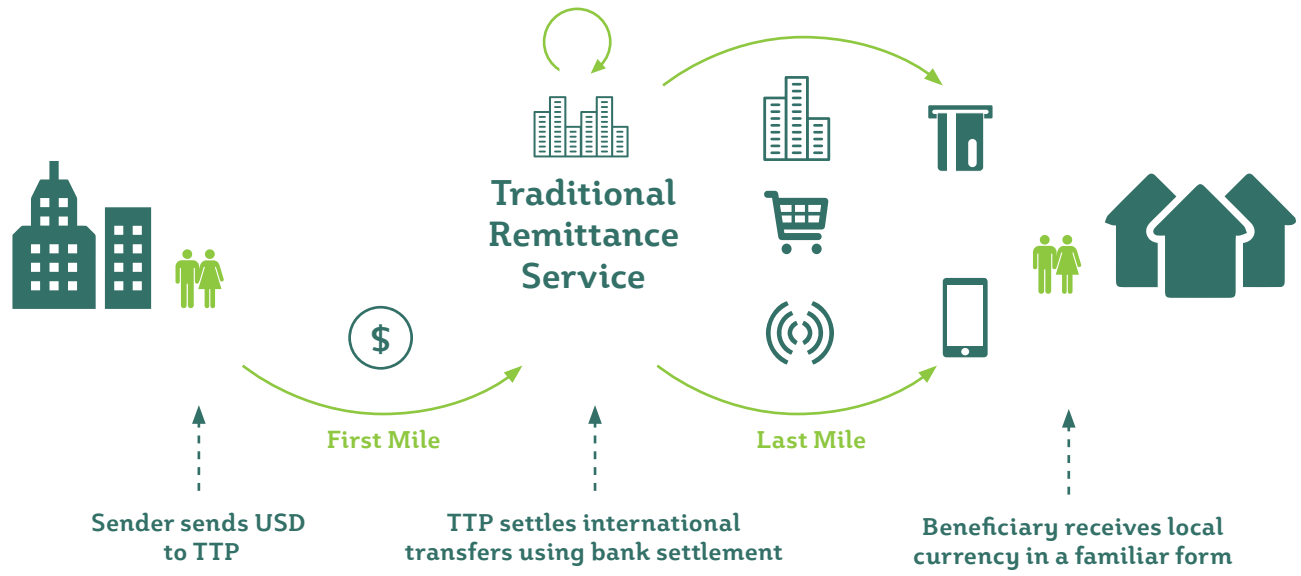


In principle, this model gives remittance providers an opportunity to reduce the costs and time taken for international settlement and potentially to take advantage of more attractive foreign exchange rates. However, the highest costs in the remittance business arise (arguably) at the first and the last miles – acquiring customers' remittances, and delivering local currency to beneficiaries. Thus, such a pipe model may provide cost-competitive remittances in a strictly limited number of remittance corridors as it only substitutes the middle step of the remittances (the cross-border settlement) with a Bitcoin-based, low-cost, fast-paced alternative (see Figure 6, below, for a comparative example of a traditional remittance model).

As noted by Luis Buenaventura, a Bitcoin remittance specialist who previously worked with Rebit.ph:

> "To send the equivalent of $10 (about a day's minimum wage in the Philippines) from one city to another, all the pawnshop networks charge 6-7%. When a Bitcoin company, acting on the behest of its sending customer, wants to transfer $10 from one city to another, it needs to pay that same fee."[15]

Figure 6: Correspondent Banking-Enabled Remittance Service



[15] https://medium.com/@Cryptonight/bitcoin-doesn-t-make-remittances-cheaper-eb5f437849fe#.p1nsh05h8.Accessed February 12th

Some of the key issues for any model that builds on Bitcoin as part of its service are regulatory uncertainty and partner network management. It is crucial to maintain a mutually trusting relationship with intermediaries in emerging economies that provide last mile services, such as mobile money services and CICO (Cash-In/Cash-Out) at local branches/agents. Partner network management can be impeded by differences (and insufficiencies) in regulations and lack of awareness about Bitcoin-related businesses among industry players, including supervisory authorities.

Such problems are exemplified by the recent BitPesa/Safaricom legal action in Kenya. Safaricom (operator of M-PESA in Kenya) had chosen to suspend last mile service to Bitcoin-enabled remittance providers, citing regulatory concerns and highlighting the Central Bank of Kenya's (CBK)[16] warnings to Kenyan citizens about the risks of holding funds in Bitcoin (noting that they are not regulated in Kenya).[17] This case speaks to the lack of awareness, trust and supervisory certainty around Bitcoin-related businesses within both financial services incumbents and regulators in emerging economies. The true concern here should be how to properly regulate currency exchange services that enable BitPesa and other remittance providers to exchange Bitcoins for local currency (in this case, Kenyan Shillings) at the end points of international settlement (that is, the process whereby BitPesa exchanges Bitcoins for Shillings, which are presumably held in a Kenyan bank; a process which does not involve M-PESA in any way). AML processes should be closely monitored and managed adequately.

3.2 Charities and international aid programmes/dedicated coins

The inherent transparency and traceability of cryptocurrency transactions suggest that there should be a way to maintain the integrity of funds dedicated to international aid, thus ensuring they are used for the purpose for which they were intended.

The recent report by the Chief Scientific Adviser to the UK Government[18] suggests the concept of 'sterling-linked coins' that are issued on the Blockchain and backed by real sterling value. This can be achieved by adding metadata to Blockchain transactions on the contents layer.[19] The key idea is that:

> "...the use of unique sterling-linked coins could prevent them from being spent on items not deemed appropriate within the international aid context."[20]

As another example, the FATF-mandated Risk-Based Approach (RBA) could be codified into the shared value transfer protocol. One can also envisage dedicated, restricted-use coins that can only transact small volumes per user and be accepted as payment instruments in a limited number of shops and other organisations.

For international aid programmes based on a restricted-use cryptocurrency to succeed, a certain level of local acceptance of such a form of payment is required. Due to the implausibility of sufficiently widespread adoption, the last mile of aid would often need local currency in the form of cash or mobile money. In both circumstances, when limited use coins get transformed to these forms of money, they lose their embedded protocol enforcement power and traceability. Yet it would appear to be useful to trace and restrict 'coins' up until they reach the last organisational member of the value chain, such as a local MMO.

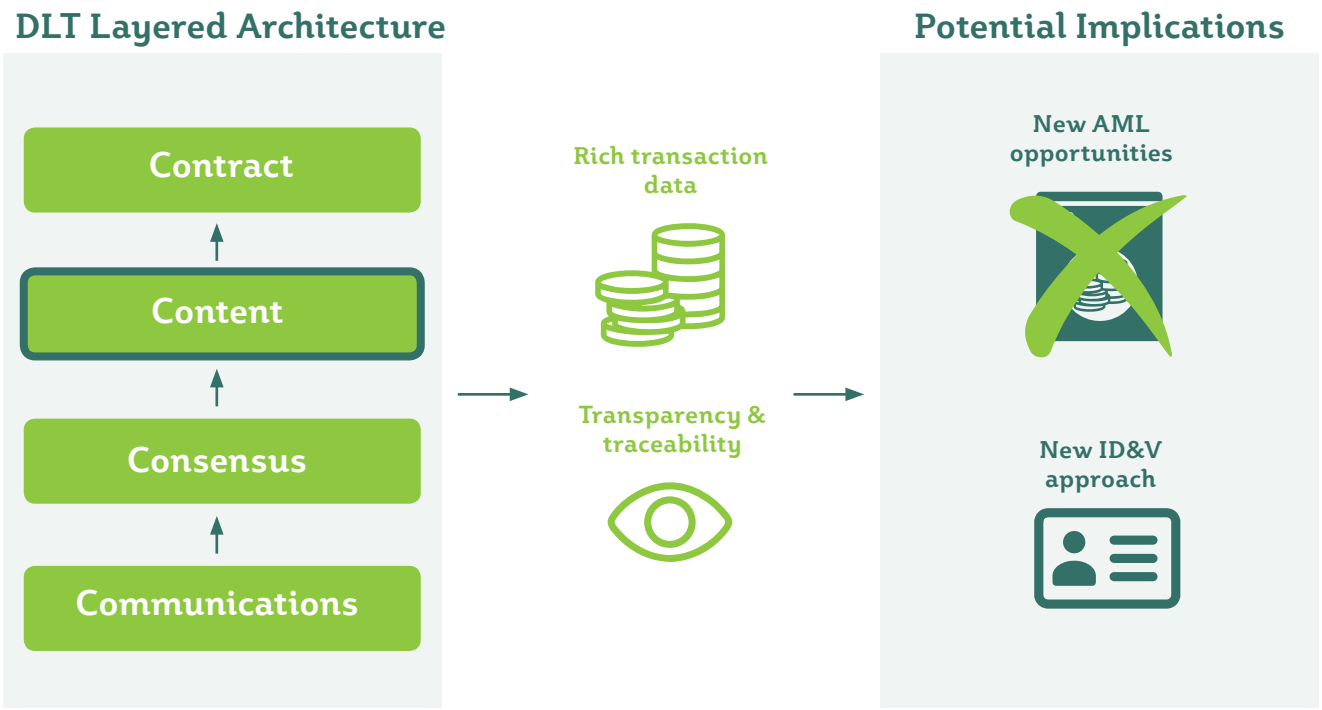
3.3 KYC/AML/CFT

Since the mid-2000s, there has been an increasing focus on Anti-Money Laundering (AML) and Countering the Financing of Terrorism (CFT). Autonomous electronic cash systems like Bitcoin have attracted the attention of AML authorities as a relatively easy route to launder money. As Bitcoin is a persistent technology ('permissionless') that can survive without regulatory approval (although regulation, of course, affects Bitcoin's value and adoption), it is used, and will continue to be used, to sidestep regulation. It is a matter of degree.

The transparency and traceability of Bitcoin transactions create new opportunities for regulatory oversight (Figure 7). AML processes could shift from expensive and somewhat ineffective gate-keeping combined with floods of suspicious transaction monitoring to a combination of a variety of different AML applications that continuously review the distributed ledger entries to find transactions indicative of misbehaviour (at which point, law enforcement agencies could apply for warranted access to the unencrypted ledger entry or relevant metadata).

[16] http://www.coindesk.com/safaricom-and-bitpesa/
[17] https://www.centralbank.go.ke/images/docs/media/Public_Notice_on_virtual_currencies_such_as_Bitcoin.pdf
[18] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/492972/gs-16-1-distributed-ledger-technology.pdf, pp.68-69.
[19] The group of technologies that allow this are called 'coloured coins'.
[20] As per previous footnote.

Figure 7: AML and KYC (ID&V) Potential of DLT



For example, British start-up Elliptic has been providing tools for law enforcement authorities to link real identities to Bitcoin transactions. Elliptic maps Bitcoin transactions to real identities where possible by analysing information from the 'dark web'. It gives each transaction a risk rating based on the history of ownership behind the transferred funds. For example, if the Bitcoins came from one of the 'mixing' services,[21] their risk rating would be marked high. One can argue that it is easier and faster to trace Bitcoin transactions than it is to trace cash movements (and sometimes even bank transfers[22]) and therefore the AML monitoring possibilities for cryptocurrency transfers are broader. One can envisage human-free AML processing either embedded in the payment protocol itself or built on top of it.

As Bitcoin provides new levels of transparency and traceability, advanced AML rules can be designed to enhance fund transfers. The Risk-Based Approach (RBA) can be redesigned to regulate financial transactions according to the new AML opportunities offered by the cryptocurrencies. The risks can be estimated bearing in mind the availability of identity information, the volume/frequency of the transfers (as is done currently) and the provenance and entire historical chain of custody of the funds (as becomes possible with traceable cryptocurrencies such as Bitcoin).

These different elements and approaches combine to suggest that there is no reason for Bitcoin and other cryptocurrencies to be regarded as inherently more dangerous; the issue is more that the supervisory authorities did not (until recently) understand the technology, and had no tools to carry out their supervisory duties. In this way, cryptocurrencies are no different from the early days of international banking (bar the velocity of transactions, of course), and the necessary tools, currently under development and testing by a range of organisations, will allow authorities to supervise Bitcoin transactions (at least where they touch fiat currencies) in the same way as any other transaction.

[21] The services that pool Bitcoin transactions together and redistribute the virtual currency back to the users with the intention of making the mapping of the real identities of their customers to their Bitcoin addresses difficult.

[22] Because of non-cooperative jurisdictions. See http://www.fatf-gafi.org/publications/high-riskandnon-cooperativejurisdictions/documents/public-statement-february-2016.html

4. Funds Transfer Model Based on Private Distributed Ledger Technologies

4.1 Clearing & Settlement

As mentioned in the introduction to this document, an alternative application of this technology is to consider DLT as a means to clear and settle obligations between different financial institutions, either domestically or internationally.

Currently, inter-institutional switching and settlement is weak across many emerging economies. The use of private distributed ledgers for inter-organisational transaction management could be beneficial for clearing and settlement services in these economies, as it may help financial institutions to operate more effectively and efficiently in a limited trust environment. Private distributed ledgers could form the basis of efficient, cost-effective clearing and settlement services for banks, mobile money operators, microfinance institutions and other financial service providers, through the use of decentralised, DLT-based settlement systems.

This approach holds out the potential for (relatively) cheap services, leapfrogging the massive switches and settlement processing systems of the developed world. This approach is different from cryptocurrency-based solutions as it does not focus on the usage of any virtual currency that has an exchange rate against other currencies. Instead, DLT-based clearing and settlement is a platform that provides for an exchange of national (fiat) money in a new form. There have been notable initiatives in this space by Stellar,[23] Ripple[24] and Level One Project.[25] There are two key categories of private DLT applications in inter-organisational clearing and settlement: international (cross-border) and domestic.

4.1.1 Cross-border clearing and settlement

Figure 8: Private DLT for Inter-Organisation Cross-Border Settlement

Distributed ledgers address the 'single point of failure and corruption' and opacity issues of distributed systems. Distributed ledgers also tackle the inefficiencies of manual processes, in particular in relation to reconciliations and dispute resolutions; all problems that are magnified if the organisations in question are based in different countries. The ultimate goal of this model is to provide interoperable financial instruments and connected markets. It is clear that private DLT offers significant opportunities in this space.

[23] http://letstalkpayments.com/how-blockchain-is-facilitating-financial-inclusion-in-africa/
[24] https://ripple.com/insights/ripple-and-xrp-can-cut-banks-global-settlement-costs-up-to-60-percent/
[25] https://leveloneproject.org/

4.1.1 Cross-border clearing and settlement

Figure 9: Private DLT for Inter-Organisation Domestic Settlement

Despite the potential for substantial wins from a multinational distributed ledger solution, the inevitable concerns around distribution of control and liabilities among member organisations are likely to be a significant impediment to development. Consequently, we would consider that domestic inter-organisational distributed ledgers would be more likely to gain traction in the short and medium term.

The domestic application of private DLT for clearing and settlement offers the potential for significant advantages in clearing and settlement across the financial sector (as it would be applicable to banks, MMOs and MFIs), offering as it would fast, reliable and cost-effective services without an expensive centralised operation. It would support the development of innovative services by participating institutions, and support the domestic development of the sector.

There are of course impediments to the adoption of private DLT for domestic clearing and settlement, not least regulatory; we have already seen that regulatory authorities have been slow off the mark in addressing technological developments.

There would also be some concerns about long-term developments, in particular in relation to the potential need to interconnect multiple domestic distributed ledgers (for example, between countries, to form an international clearing and settlement service), and also in relation to ensuring interoperability between distributed ledgers and private DLT-based settlement applications (including concerns around multiple fiat currencies).

4.2 Implications

In comparison with more traditional, centralised initiatives, the private DLT model for inter-organisational clearing and settlement could be considered more secure (less opportunity for systemic fraud), less costly to set up, and more scalable (easier to on-board organisations). The on-boarding process for financial institutions may become more straightforward and cheaper, due to reduced capital requirements (since reconciliation and settlement on private DLT-based platforms could potentially happen in near real-time, thus reducing counterparty risk).

The resulting reduced entry barriers for financial institutions may in turn lead to more accessible financial services.

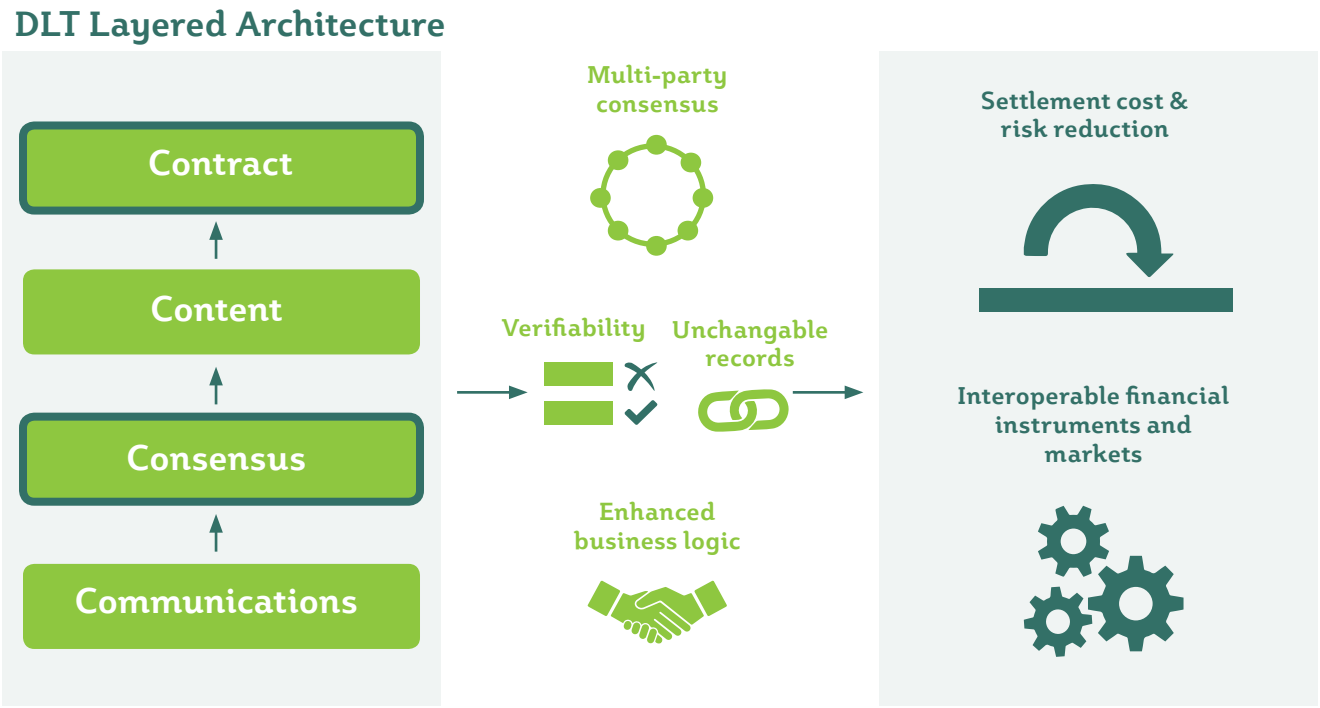
Arguably, private DLT-based settlement systems in certain emerging economies could face less politically charged resistance than centralised solutions might do, due to the ability to achieve multiparty consensus by the means of decentralised software (Figure 10). Another significant benefit is that their distributed architecture means that they do not need to operate at scale from day one in order to make commercial sense for participants and system builders.[26]

[26] Further research and analysis is needed to support these arguments.

The private DLT model also has promise in providing flexibility and transparency to inter-organisational operations. Flexibility in this context means that it is relatively easy (from a technical perspective) to change the rules and processes underlying clearing and settlement on the distributed ledger, as organisations develop their understanding and familiarity with this new way of doing business. Moreover, it may be useful to create enhanced business logic, itself automatically executed on the distributed ledger. Such business logic (provided by the contracts layer of the DLT architecture) might be used for inter-organisational insurance, lending and liquidity management, among other things (Figure 10).

As for transparency (and hence verifiability), this characteristic of DLT may be useful in providing distributed KYC/CDD and business due diligence models in addition to transactional data sharing. Applications of DLT technology that focus on providing data integrity are important for funds transfers but also for richer financial services such as investments, lending and insurance. Timely, accurate and detailed information on individuals is often reported as a key barrier to credit decision making by financial providers. DLT has the potential to act as a reliable 'store' of identity information available in near real-time and as a generator of dynamically changing identity attributes (such as creditworthiness). However, this is not straightforward. Reliability comes from intrinsic DLT characteristics (such as amend-only transaction history across parties and cryptographically secured transactions), but not exclusively from them. To ensure trust and reliability, it is important that DLT solutions are developed in accordance with national laws and security standards, and take into consideration the views of all stakeholders.

Figure 10: Settlement Cost, Risk Reduction and Interoperability Potential of DLT



Although cryptocurrency-based applications for remittances already function at a small scale in a number of markets, by contrast private DLT-based applications are only beginning to emerge, because they require significant coordination effort and agreement within the private and public sectors.

5. Conclusion

DLT is a promising branch of technology with a wide range of possible applications in the financial sector. DLT creates opportunities for new ways of performing funds transfers, payment settlement and regulatory oversight, due to its decentralised, replicated and transparent nature.

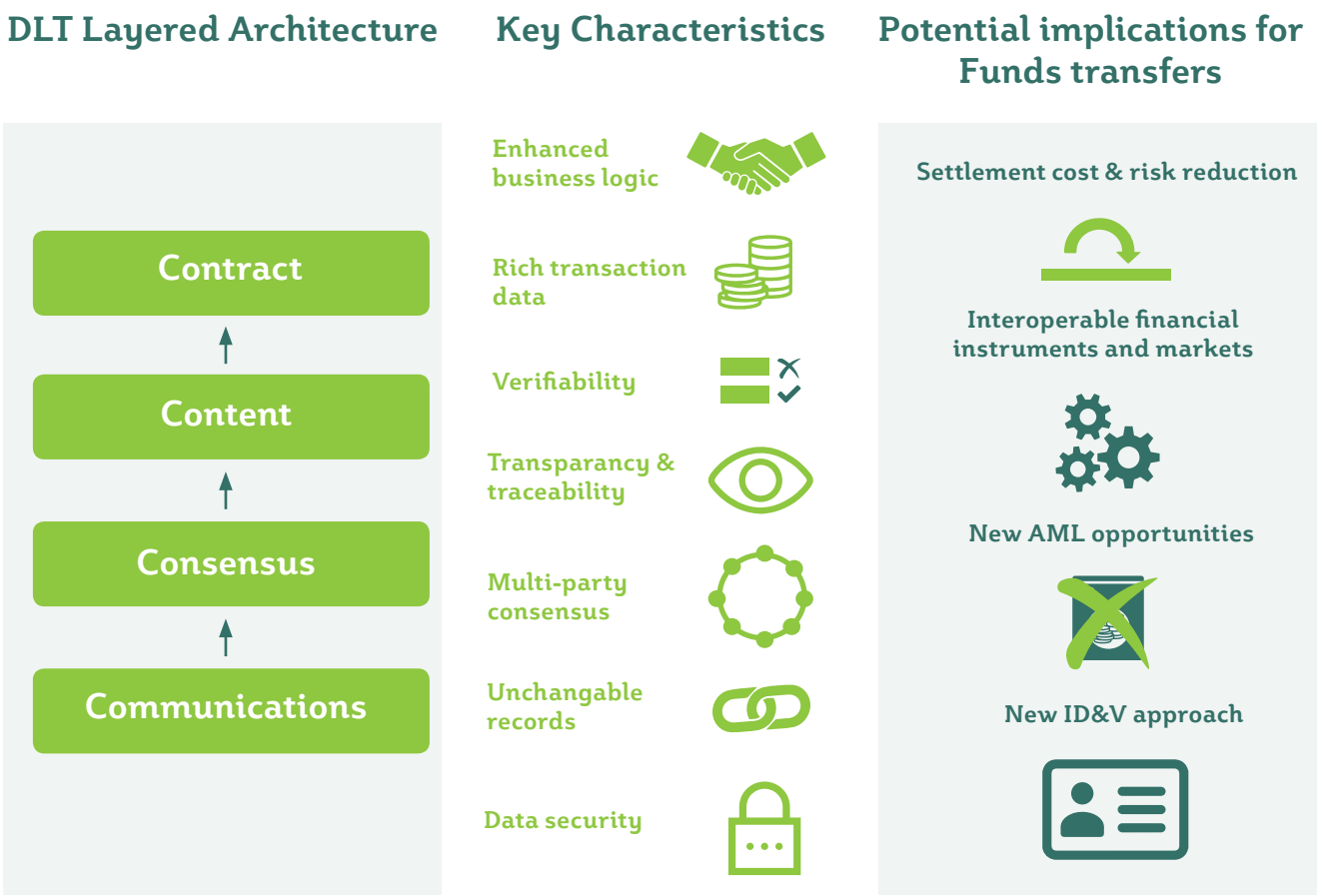
There are two different approaches to how DLT can assist in the area of fund transfers in emerging markets:

- **One approach** is based on the usage of public DLT in general, and Bitcoin in particular, as a financial instrument and as a platform for cross-border, high-speed, low-cost value transfers for consumers, businesses and international agencies.
- **Another approach** considers the use of private DLT as a means to clear and settle obligations between different financial institutions either domestically or internationally.

Concerns remain around the legal standing of DLT-based applications, as well as the standards and interoperability of distributed ledger systems.

Nonetheless, the technology has significant promise in reducing the cost of remittances, increasing speed of settlement, reducing settlement risk, decreasing entry barriers for financial institutions, improving the interoperability of different financial instruments and enhancing the regulatory frameworks that oversee funds transfers by improving KYC/CDD and AML processes.

Figure 11: Distributed Ledger Architecture and its Potential for Funds Transfer



About Consult Hyperion

Consult Hyperion (www.chyp.com) is an independent IT company that specializes in using considered best practice from within industrialized economies to deliver transformational products and services in emerging economies. Our focus is on the design of intuitive secure transparent Digital Financial Services (DFS) which require minimal staff training, promote self-sufficiency within the local market and can be scaled nationwide. Our successes include M-PESA in Kenya and the GES TAP eVoucher delivery system in Nigeria.

Formed in 1984, Consult Hyperion's core business is the design and implementation of new retail payment services, primarily for the international payment schemes American Express, Mastercard Worldwide and Visa Inc. as well as the domestic payment schemers in Australia, Canada, Scandinavia and the USA. Our clients range from the global payment brands to national governments via local regulators, international and local banks, non-banking financial companies (NBFCs), MFIs, telecoms operators, NGOs, donor agencies and their suppliers, across the globe. The products and services we have helped to design and deliver are used by hundreds of millions of people across every continent, every day. There will be at least one in your wallet or phone.

About FSD Africa

FSD Africa is a non-profit company which aims to increase prosperity, create jobs and reduce poverty by bringing about a transformation in financial markets in Sub-Saharan Africa (SSA) and in the economies, they serve. It provides know-how and capital to champions of change whose ideas, influence and actions will make finance more useful to African businesses and households. It is funded by the UK aid from the UK Government.

FSD Africa also provides technical and operational support to a family of ten financial market development agencies or 'FSDs' across sub-Saharan Africa called the FSD Network.

About the FSD Network

The FSD Network is an alliance of organisations or 'FSDs' that reduce poverty through financial sector development in sub-Saharan Africa.

Today, the FSD Network:

- Comprises two regional FSDs in South Africa (est. 2002) and Kenya (est. 2013) and eight national FSDs in Kenya (est. 2005), Ethiopia (est. 2013), Mozambique (est. 2014), Nigeria (est. 2007), Rwanda (est. 2010), Tanzania (est. 2005), Uganda (est. 2014) and Zambia (est. 2013)
- Is a leading proponent of the 'making markets work for the poor' approach
- Specialises in a number of themes from agriculture finance and savings groups to payments, SME finance and capital market development
- Represents a collective investment of $450+ million by DFID; Bill & Melinda Gates Foundation; SIDA; DANIDA; Foreign Affairs, KfW Development Bank; the MasterCard Foundation; RNE (Netherlands); Trade and Development Canada; and the World Bank
- Spends $55+ million per year, predominantly through grant instruments
- Employs over 130 full time members of staff and a uses wide range of consultants

fsdafrica

FSD Africa, Nairobi, Kenya
info@fsdafrica.org
@FSDAfrica

www.fsdafrica.org

consult hyperion
securing tomorrow's transactions

Consult Hyperion, 12 The Mount
Guildford, Surrey GU2 4HN
info@chyp.com
@chyppings

www.chyp.com

UKaid
from the British people

Department for International Development
enquiry@dfid.gov.uk
@DFID_UK

www.gov.uk