

Kora Network: An infrastructure for inclusive, community-owned financial systems

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Abstract

Kora is a popular musical instrument in the Western/Eastern region of Africa frequently played in [songs of celebration or to pass a message of hope to its listeners](#).

Kora is a project of hope for billions of people who are underserved by the current financial system and are burdened by expensive and inconvenient access to financial services. They are excluded from better solutions due to high costs, lack of proper identity, poor access to banking locations, and mistrust or poor understanding of the banking system. Furthermore, the learning curve of many existing platforms, and reasons such as lack of access to infrastructure like electricity, expensive access to internet, and insufficient capital to afford a smartphone and a steep learning curve.

At Kora, we believe that technology should empower instead of displace existing communities and networks in order to reach the understanding and trust needed for massive adoption.

The Kora Network will be built on four layers of infrastructure to provide a low cost, universal access financial services platform accessible via SMS/USSD on feature phones, or with internet access via mobile app, enabled by blockchain technology. This will help communities build self-sustaining, community-owned financial services ecosystems. By drastically reducing the cost and time required to provide financial services, and drawing a diverse set of stakeholders into an interoperable network, it will unlock the Long Tail of the global economy, benefiting populations most in need and enriching the global economy by unlocking the capital, intellect, and creativity of the underserved.

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Problem

Access to financial services, such as the ability to securely store and transmit value, take out a loan, or insure your assets are fundamental to a person's ability to manage and grow their wealth. For example, in 2002 when Mexican bank Banco Azteca opened more than 800 bank branches specifically focused on providing goods and services to the lower and middle income population, there was a 7.6% increase in informal business owners, a 1.4% increase in employment, and a 7% increase in average income¹.

However, according to The 2014 Global Findex Database there are an estimated 2 billion adults who are denied access to these services.² This exclusion of billions of people from growing and accumulating their capital has disproportionately increased the gap between the rich and the poor, leading to constant agitation in various regions, social instability and indirectly causing political instability. This is both a humanitarian crisis and an economic crisis as a third of the world's potential for value creation is ostracized.

Of the many difficulties the unbanked face, we have identified 5 main barriers to financial inclusion:

Perceptions that the underserved have little value

Due to the belief that the poor cannot save and have no money to save, some providers will choose not to provide the same access to financial services as others. For banks, the perception has been that for areas with low economic development, or areas with sparse population and customers that would be transacting in what would traditionally be considered "small" amounts, the operational cost of opening up branches outweigh the perceived benefit for providing these services. However, PwC estimates that the un(der)banked population hold at least \$360 billion in unmet deposits in 2016 alone.³ In a 2016 McKinsey report, they estimate that widespread adoption of financial services through digital finance could result in a \$3.2 trillion increase in GDP of all economies by 2025. Additionally, they believe that digital finance could help provide loans to more people and business in developing countries of up to \$2.1 trillion, and could even save financial institutions \$400 billion annually in direct costs.⁴ Having formal means to manage this money would open up larger opportunities for account owners to contribute to the economy and grow their wealth.

¹<https://openknowledge.worldbank.org/bitstream/handle/10986/4173/WPS4981.pdf>

²<http://documents.worldbank.org/curated/en/187761468179367706/pdf/WPS7255.pdf>

³<https://www.strategyand.pwc.com/media/file/DeNovo-Quarterly-Q2-2016.pdf>

⁴McKinsey Report 2016, Digital Finance for All: Powering Inclusive Growth in Emerging Economies

Cost of providing and accessing financial services

Being able to provide affordable products and services are paramount when it comes to achieving financial inclusion. However, with the overhead required to open and operate a branch including property fees, staff headcount, and IT infrastructure, banks need to reclaim expenditures through charging fees for services such as loans, account maintenance, ATM withdrawals and money transfer, therefore requiring a certain level of return from their customers to be worth serving. As a result, many areas where there is low economic development are left out of financial institutions' target markets, leaving populations with limited and expensive options when it comes to managing their money. For customers living in rural areas, the travel required to access financial facilities such as bank branches or ATM's can require more than a day's travel, becoming a costly and time consuming activity. This is a leading barrier for 20% of the global unbanked, who cited banks being too far away as a reason for not having an account⁵. This can be further demonstrated in countries such as Kenya, where there are as few as 9.5 ATM's and 5.2 bank branches per 100,000 people, or the Philippines with 17.7 ATM's and 8.1 bank branches per 100,000. Compared with that of 209 ATM's and 24.3 bank branches per 100,000 in Canada or even 119.6 ATM's and 46.2 bank branches per 100,000 in Brazil, access to services for many countries are considerably more restricted⁶. Even for those where distance is not an issue, the cost to transact and the available products and services may not serve the customer's needs and therefore go by unused, such as in India, where despite 60% of people now owning accounts due to a scheme for providing financial access to all, 43% of those bank accounts have gone by unused for 12 months⁷. Research has been conducted into why greater access in India has not driven adoption, with cost coming out as a leading factor, both directly and indirectly. For a large number of recipients living farther away, it can cost up to 50% of their daily earnings to travel to the nearest banking facility, and 70% of those questioned stated losing a full day's work due to the length of the queues⁸. Where banking services are accessible, the associated costs are often not tailored to the realistic income of those who use it, and as such are still inaccessible for most. This is due to costs incurred to banks for providing IT and communication infrastructure in areas where infrastructure is less developed, as well as transportation to these areas and security costs. As such, banks have to make back these costs by charging low-income customers high fees for services. The result of this is counter productive and prohibitive, with 59% of those without an account indicating a lack of sufficient money as a leading barrier to access, suggesting that formal banking services are not yet suited nor tailored for the poor or lower income users⁹.

⁵https://www.sc.com/en/resources/global-en/pdf/Research/Financial_Inclusion__Reaching_the_unbanked_04_09_14.pdf

⁶https://www.sc.com/en/resources/global-en/pdf/Research/Financial_Inclusion__Reaching_the_unbanked_04_09_14.pdf

⁷<https://www.theguardian.com/global-development-professionals-network/2015/may/28/millions-more-have-a-bank-account-but-what-is-the-impact-on-global-poverty>

⁸<http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=6F5F7BCA5F11F4C30732E3971D43E3D5?doi=10.1.1.188.1378&rep=rep1&type=pdf>

⁹<http://www.worldbank.org/en/topic/financialinclusion/brief/achieving-universal-financial-access-by-2020>

Lack of identification

A staggering 1.5 billion people worldwide lack any form of valid identification¹⁰. Having official or valid ID is essential for opening accounts and accessing financial services anywhere, but is not something readily accessible or easily obtainable to those in developing countries. To make access even more difficult, the requirements for opening an account can be particularly onerous for low income populations, requiring complicated paperwork and multiple forms of ID. This problem begins at birth, as 50 million children each year go by unregistered without a birth certificate to be able to obtain ID later on, and with Sub-Saharan Africa and South Asia making up 73% of this equation¹¹. Children make up nearly a third of all those without ID and are vulnerable to consequences of not having ID, including being at risk of entering into forced labour, marriages, and human trafficking. Beyond birth registration, the ability to obtain national identification is exacerbated through the lack of access to administrative offices where registrations can be made. For example, it can take up to 5 days travel for those living near the Peruvian Amazon to reach administrative services¹². Other significant barriers to obtaining ID relate to costs, whether directly through the the registration fee, or indirectly through transportation, missed work, and bribery or corruption. In Cameroon, for instance, 2,700 registration offices serving a population of 2.7 million had less than 1 registration per day. Even where access to offices is geographically convenient, complicated and lengthy registration processes can be a deterrent for people.

Lack of trust and technological understanding

Trust is essential to how one chooses to store and send their personal finances, and for many of the underserved there exists a lack of trust in both traditional banking systems and modern financial technology. Many people have chosen not to use banks to conduct their financial needs because they are often seen as dishonest and to be exploiting those most in need. In South Africa, for example, people receiving grants directly into their bank account were targeted by financial institutions providing other products such as micro-loans or funeral coverage. Instead of offering these additional services to customers giving them choice over what products were relevant to them, they “signed them up” automatically deducted the cost of these services from each recipient, unlawfully taking money from people most in need of it.¹³ A number of banking scandals including embezzlement, fraud, corruption, or insolvency throughout Kenya and other African countries also lead to people losing money or having restrictions in liquidating their assets. One such example, known as the “Goldenberg” scandal, involved the Governor of the Central Bank and other government officials in Kenya in which \$600 million passed hands through fraudulent

¹⁰<http://documents.worldbank.org/curated/en/156111493234231522/pdf/114628-WP-68p-TheStateofIdentificationSystemsInAfricaASynthesisofIDDAssessments-PUBLIC.pdf>

¹¹https://www.unicef.org/esaro/Technical_paper_low_res_.pdf

¹²<https://citizen.co.za/news/news-africa/1698536/lifestyle-society-identification-children-un-worldbank/>

¹³<https://www.weforum.org/agenda/2017/04/financial-inclusion-south-africa/>

means.¹⁴ In Uganda, 4 commercial banks holding 12% of the country's deposits disbanded within 13 months of each other.¹⁵ While some of these banking crises occurred more than 2 decades ago, the reasons that people choose to transact in cash over bank accounts due to lack of trust suggest that this discrepancy between banks' objectives and customer's needs has yet to be addressed.

Modern financial services such as mobile money and ePayments are helping to bridge the gap between the banked and unbanked, but with new and unfamiliar technology comes uncertainty surrounding its legitimacy, privacy, and security. There is a lack of trust in financial technology, including ATM's and online banking, for fear that money won't reach the recipient. In South Africa, fear of fraud involving ATM's and mobile or online banking services were the number one reason that people preferred to transact in cash, believing it to be a more secure way of settling payments or transfers than transacting through digital methods where money was viewed as more likely to be gone forever.¹⁶

Lack of financial literacy

Financial illiteracy is an especially concerning issue in developing countries, and can be attributed back to both a lack of available options as well as limited knowledge of how to make positive financial choices. Many people lack the education and understanding needed to effectively manage their own finances, from selecting the best products and/or services for their needs, to knowing how to use payment channels including ATMs and mobile payments. With limited knowledge, people are at risk of making poor financial decisions that adversely affect their finances or put them into more debt, such as acquiring loans with interest rates they can't afford, over-investing in risky or fraudulent products such as pyramid schemes, or paying unreasonably high charges on remittances or transactions. Various studies have highlighted the implications surrounding lack of awareness, where in South Africa, 60% of those questioned did not properly understand the term "interest", and over 66% of those in Zambia are unaware of the uses of basic financial services such as ATM's, checking accounts and debit cards.¹⁷ This concerning lack of awareness is preventative to financial inclusion where people will continue transacting in cash, and where they do make financial choices will be uninformed could lead to greater poverty. Labourers in India demonstrated this when over 50% who were surveyed claimed they store their wages in cash but borrow from lenders at high interest rates.¹⁸ This type of behaviour can have a disastrous effect on people's financial situations, finding themselves entering into more debt. Where banks may offer appropriate products or services for low income users, most often they are not properly communicated to their customers as one study in Kenya showed, where banks that were found

¹⁴https://web.stanford.edu/pdupas/Challenges_DupasEtAl2011.pdf

¹⁵https://web.stanford.edu/pdupas/Challenges_DupasEtAl2011.pdf

¹⁶<https://www.weforum.org/agenda/2017/04/financial-inclusion-south-africa/>

¹⁷T Kefela, Ghirmai. (2010). The Case For Financial Literacy in Developing Countries: Promoting Access to Finance by Empowering Consumers. *Educational Research and Reviews*. 5. 205-212.

¹⁸T Kefela, Ghirmai. (2010). The Case For Financial Literacy in Developing Countries: Promoting Access to Finance by Empowering Consumers. *Educational Research and Reviews*. 5. 205-212.

to offer products targeted for the poor had not educated their customers on the product or its benefits, and as such customers that could have benefited weren't offered the opportunity to use them.¹⁹ Additionally, terms and conditions and disclosures of any products purchased by customers may not be communicated and be more detrimental than beneficial. Similarly, the same research conducted in India to establish the reasons for low adoption rates showed that 85% of customers were not adequately informed of the benefits of their account.²⁰ If those customers of the bank are not receiving information on available products, those living further away in rural areas are unaware of products and services that could be utilised effectively to make positive financial choices. Countries need to work on developing financial literacy programs to educate people on the above so they have more options and can more effectively choose how to manage their money.

¹⁹<https://www.microfinancegateway.org/sites/default/files/mfg-en-case-study-banking-on-change-breaking-barriers-to-financial-inclusion-jan-2013.pdf>

²⁰<http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=6F5F7BCA5F11F4C30732E3971D43E3D5?doi=10.1.1.188.1378&rep=rep1&type=pdf>

Related Work

There are many groups that have been working on this challenge, and each bring their own approach to the table while experiencing some shortfalls.

Banks have historically provided these services, and continue to account for the majority of financial services worldwide. However, the high cost to serve, low profitability, and lack of identity of the underserved makes them an unattractive market segment for traditional banks. As a result many banks choose to focus on market segments that already have some degree of wealth.

Local ad-hoc networks have existed for centuries and are generally trusted solutions for providing financial services within the community. Services through these informal yet sophisticated models, such as credit associations or rotating savings clubs, are often the preferred alternative to traditional formal institutions, with 48% of adults in Sub-Saharan Africa using these networks as their primary means to save. With these clubs, the community pools together their capital, to later distribute it back amongst the community members, or to use for lending purposes. These open up opportunities people would not be able access at banks, as stringent ID requirements and high transaction costs are not required. In Nigeria alone, 69% of adults who save do so using these clubs, also known as esusu, ajo, cha, or adashi²¹. While these networks are more easily accessible and convenient, they still pose a lot of gaps in the road to financial inclusion as their reach is confined to within their community, the interest rates on any loans can be high, they cannot be used as a form of credit history, and offer no security due to the absence of any regulations.

Mobile money businesses have helped drive a significant improvement in achieving financial access for those who were excluded from traditional institutions, and bridging the gap between the banked and unbanked. They have been credited in helping to reduce the unbanked population from 2.5b to 2b.²² Mobile money operators (or MMOs) such as M-Pesa have brought cheap, quick, and convenient money transfers to underserved populations, which can later be used to obtain a loan or invest. However, there are still a number of limitations MMOs face. The transaction services they provide are often not interoperable with other MMOs or banks, meaning transactions are only useful within a closed ecosystem. Many MMOs have struggled to get penetration in more than a single region due to reliance on a single national currency. Furthermore, MMOs hoard data as a proprietary advantage instead of giving ownership back to the customer. While MMOs have made great progress, the accumulation of these barriers slows down adoption.

A number of **blockchain projects** have proven their ability to store and transmit value across national borders at enormous scale and low cost, but many require a sophisticated understanding of the technology, access to smartphones and internet access. For an average unbanked person living on less than \$2 a day, the requirement for a \$50 smartphone, internet data at \$10 per month and electric bills to keep the phone charged regularly (especially in areas with inconsistent infras-

²¹<http://www.worldbank.org/en/news/feature/2012/04/19/three-quarters-of-the-worlds-poor-are-unbanked>

²²<http://www.wsj.com/ad/article/mlf-women-around-the-world-face-hurdles-to-financial-inclusion>

tructure) are out of their scope. Additionally, projects that introduce access to financial services through new and unfamiliar methods face trust barriers with users, especially when it involves their personal funds.

By learning from the past, we can build a better future. Summarizing the above, the components required for wide-scale, critical mass, sustainable adoption are:

- **Low cost:** Oftentimes the people with the least wealth are those who need financial services the most. No one should be excluded from the Kora Network because of their level of wealth.
- **Universal access:** Requiring a user, merchant, or agent to have internet access, a smartphone, or have a sophisticated understanding of technology or finance is a barrier that is implicitly tied to wealth. Everyone should be able to benefit from the Kora Network even if they don't have internet access or extensive education.
- **Engaging with existing communities:** Financial services providers have always existed within communities to provide much needed services. The Kora Network will enable these providers and networks instead of replacing them.

The Kora Network will pull together multiple existing solutions alongside these principles to provide financial inclusion while avoiding many of the shortfalls previous attempts have faced.

Building Blocks for Inclusive Financial Systems

The Kora Network will be a public blockchain that provides the tools needed to build a self-sustaining, community-owned ecosystem for circulating and accumulating capital within a community. “Self-sustaining” is defined as the wealth in both the community as a whole and the majority of the community increasing, while “community-owned” is defined as the community itself providing most of the key roles when circulating capital. This includes the ability to validate identity, and to use that identity to store, transfer, or lend money, make payments, and to provide or access value-added services like lending, marketplaces, benefit distribution and digital education, even without internet access or a smartphone.

Value will be transferred electronically via the blockchain, and if needed, is converted from electronic to fiat through local agents. This builds a transaction or service history and proof of informal funds through friends and family that can be used to obtain loans from 3rd party lending services connected to the Kora Network.

We will be starting with four basic building blocks to construct a fully functional financial system. These building blocks are built into the Kora Network as smart contracts, and are accessible to any user on the network:

- **Identity:** Letting a user prove they are who they are, and that they did what they say they did.
- **Secure Storage:** Letting a user protect their funds from being easily stolen or devalued.
- **Money Transfer:** Transferring value from one entity to another, quickly and securely.
- **Marketplaces:** Creating venues for users to exchange money for goods, services and capital.

Kora will provide an equal opportunity for **everyone** to share in and contribute to the enormous wealth that is created globally by lowering the barrier to access by drastically reducing the cost to serve, and by helping individuals retain more of the value they create through radical transparency and access to financial services options.

The Kora Network will have a native cryptocurrency known as Kora Network Token (KNT), as well as the ability to support national currencies as an electronic, cryptographically secure token (eFiat). **The expectation is that most financial activity between users will be in eFiat instead of a decentralized cryptocurrency.** The reasoning is that many users, especially in rural areas, have a lower comfort level and greater mistrust of digital technology. This extends to digital currencies like Bitcoin. eFiat enables users to harness the benefits of digital currency while leveraging the trust people have in fiat currencies, dramatically increasing ease of use and therefore adoption. Additionally, using digital national currency will give greater clarity into the regulatory frameworks within which each financial system should be developed.

The use of eFiat will help us solve one of the biggest issues with money transfer: the “cash-in/cash-out” problem, or CICO. To provide a functioning service, money transfer operators need to ensure there is enough liquidity for users on either ends of the transaction. However, when there are significantly more users looking to be cashed-out than cashed-in, cash reserves at the cash-out point will eventually run down. The existing solution is to resolve this with a dedicated supply chain of cash. This incurs a significant overhead that is eventually passed on to the customer in the form of higher rates, as well as risk of robbery.

Anyone will be able to join the Kora Network as a **User**, and will be able to access all services available on the Network, as well as every other participant on the Network. However, certain Users may be unable to or simply prefer not to directly access the Network. Reasons for this vary from not having Internet access, to preferring not to have to run a full node or hold the native cryptocurrency needed for operations on the Network. Additionally, all users will still have to comply with the regulatory framework in their country of residence. For these use cases, we propose a role known as a **Provider**, who provides access to financial services on the Network, and is responsible for regulatory requirements. Providers can include both full-service banks and non-bank financial services providers, such as Mobile Money Operators or Money Transfer Operators.

Providers on the Kora Network will be able to issue branded tokens that are redeemable on a 1:1 basis for fiat currency from the Provider’s reserves. Each participant in the network can choose which tokens they will accept. Credit risk for accepting these tokens, which are essentially IOUs backed by the provider, can be assessed on an individual basis. Providers can choose to regularly publish audits of their reserves, build their reputation by demonstrating continued solvency, or even cryptographically prove solvency by proving ownership of cryptocurrency reserves on other blockchains, with the assumption that these would increase confidence in their solvency and therefore adoption.

We introduce the role of an **Agent**, who are Users who choose to convert between eFiat and physical cash for a commission. Agents mirror an existing role in many financial networks of a “cash-out point”, which is frequently a small business that continuously accumulates physical cash, such as a gas station or convenience stores.

In order to close the loop and make accumulating eFiat worthwhile to Agents, we increase the interoperability of eFiat through **Merchants**, which are simply other businesses that accept eFiat as a payment method. By introducing eFiat and a decentralized method of conversion between eFiat and cash, we solve the CICO problem by allowing physical cash to be continuously reused in the local community, while also providing the benefits of digital currency.

Universal Access and Identity

Considering Nigeria only, the 2017 Mobile Africa Study found an 80% penetration rate for mobile access, and 18% for internet access²³. Feature phones and SMS are still the dominant means of communication in most regions where the unbanked are domiciled due to their affordability and wide availability. They're also easy to operate, with simple interfaces, modest charging requirements, robust durability and long battery life. Furthermore, introducing financial services in a way that the unbanked are accustomed to will help overcome the initial mistrust that comes from a new solution, therefore driving adoption.

Kora will provide financial services on even the cheapest feature phones. Users access the service either through texting a number maintained by Kora Network via SMS or inputting a shortcode and using USSD. The user's transaction history is stored on the blockchain, and is consistent and accessible even if the user later upgrades to a smartphone. Kora also provides a smartphone app and a web application with greater functionality.

Historically, "thin-file" users who are unable to provide documentation to verify their activities have found identity to be a significant barrier to entry. Kora provides a hybrid on-boarding process on a tiered KYC ramp that allows users to join the network with whatever information they have, whether through government ID, referrals, biometrics or a combination. The user's transaction limits and access will increase as they add more documentation and prove themselves to be honest and credible actors. Each user will either need to connect their identity with a government-issued ID, or will need to be referred by a user who's already on the system. Each user will have a reputation score that is connected to their actions on the network, as well as the actions of the users they're connected to, including ones they transact with.

The actual "identity" of users, in the sense of a unique identifier used to sign transactions committed by the user, draws on the model pioneered by **uPort**, and is deployed as a set of proxy and model controllers²⁴. The proxy is used to receive attestations and sign transactions, and is essentially the user's **uPort** identity. The user sends transactions to the controller, which validates them and then forwards valid transactions to the proxy. In this way only the controller can be compromised - and even if it is, it can be recovered with a quorum of users. Keys to the controller contract are stored directly on the device if the user has a smartphone, and are split between the user and the Provider through **Shamir's Secret Sharing** if the user is using a feature phone.

Minimizing Cost through the Blockchain

The Kora Network will deconstruct and abstract the infrastructure needed for financial services so that new Providers can easily provide financial services as needed for Users, without the huge cost

²³<https://blog.jumia.com.ng/jumia-unveils-third-white-paper-nigerian-mobile-trends-2017/>

²⁴https://whitepaper.uport.me/uPort_whitepaper_DRAFT20170221.pdf

of establishing and running a front-to-back financial institution. It will make launching a financial services business as cheap and easy as launching a new instance on AWS, with the prime benefit of driving down costs and increasing the variety of offerings for customers.

IT headcount usually makes up between 30-40% of staff at banks, with additional costs to license and integrate various forms of banking software. On the Kora Network, core financial services software will be run on the decentralized stack, and new users can call on or fork and customize this software, allowing them to start providing one or more financial services to other users on the Kora Network at low cost and with high speed.

Operations headcount can make up another 30% of staff. This includes functions ranging from customer support and compliance to simple manual work while a system is being integrated. Financial services providers on the Kora Network can outsource these functions to dedicated providers, who provide automation that can be reused by their entire client base. This can be especially impactful for services like anti-fraud, where building models across all transactions on the network minimizes damage for everyone.

Historically, groups providing banking services are founded upon the bedrock of trust that they will keep your money safe. The huge cost involved in securing trust of assets that are perpetually under attack has allowed banks to monopolize and profit off the trust that society puts in them. With public blockchains, this trust is embedded into the blockchain, instead of within a centralized party. This shifts the balance of power towards the User, as they can enjoy unprecedented price transparency as well as greater choice in how they want to allocate their assets, driving down cost by forcing financial services providers to compete for customers instead of monetizing their monopoly with rent-seeking activities.

The final result is that a variety of financial services providers, including traditional financial institutions, niche players like Money Transfer Operators or Mobile Money Operators, or newer blockchain-native forms that have yet to emerge can utilize the infrastructure for financial services at low cost, near-instantaneous time-to-market, to an existing and interoperable network and with minimal disruption to their existing business. This in turn lowers the bar for profitability needed to make servicing users sustainable, allowing historically underserved groups to access a wider and more transparent range of services than ever before.

Community Value Networks

Kora looks to empower instead of displace existing communities by introducing new tools to help build a self-sustaining financial ecosystem. A critical ingredient to success is to ensure incentives of financial services providers are aligned with the Users in the community. A major barrier to providing financial services to the many underserved people is that existing providers are incentivized to maximize their profits. In the face of low profitability due to the combination of prohibitive cost to install and operate a branch in rural areas with sparse populations and low cash savings, many

existing providers have chosen to skip over these areas entirely. In the absence of formal options, informal options with the same incentive for profit-maximization can create predatory services for underserved groups, such as loan sharking.

We propose a design for a **Community Value Network** (CVN) that is designed to fulfill our definition of self-sustaining and community-owned. The Kora Network aligns incentives by empowering community groups that are already providing ad hoc financial services, such as savings groups, cooperatives and trade unions. A CVN is an entity overlaid on top of these networks, which can become the focal point for providing financial services to the community. This includes attesting to identity, pooling capital for lending, infrastructure investment or bulk purchases, social assistance, financial education and other services.

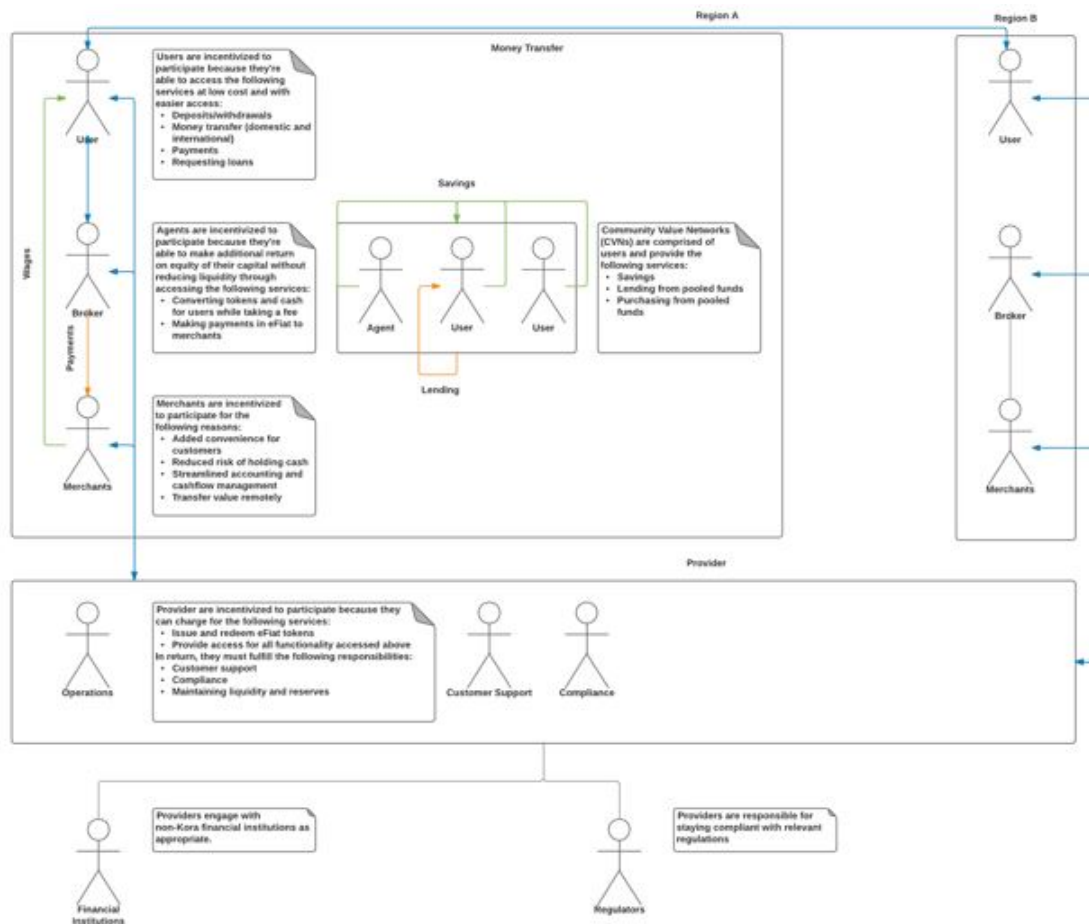
CVNs are driven by **Delegates**, which are entities the Users in a CVN have chosen to manage their capital. The governance structure for establishing Delegates is flexible, ranging from being democratically elected and having full control over all pooled funds, to each user choosing how much capital to distribute to each Delegate and which permissions they have.

CVNs also provide an important function for identity, as even in the absence of official documentation it can provide a number of attestations from members in the community with more established identity. Each positive attestation strengthens the reputation and identity of the CVN as a whole, which also strengthens its ability to do further attestations while negative attestations get penalized by lowering reputation.

The exact nature of each CVN varies and can be customized for each community. This flexibility allows CVNs to be utilized for a variety of use cases:

- **Farming cooperatives** can use a CVN to ensure the proper use of funds when buying commodities, selling produce and distributing proceeds;
- **Savings groups** can use a CVN to securely pool capital in eFiat and govern the use of that capital;
- **Churches** can use a CVN to collect tithes and distribute aid throughout the community to those most in need;
- **National trade unions** can set up CVNs both nationally and as local chapters to increase the transparency into their operations and help to fight corruption.

Sustainability is facilitated through enabling two loops of capital circulation into the community. The first is an external loop, which injects capital into the system via family members sending money home or outside investment. The second is an internal loop, where the community pools capital into Community Value Networks, which can then be reinvested into the community through personal loans, improved infrastructure, or bulk purchases of commodities.



As the ecosystem in these communities mature, their financial resilience and ability to build wealth grows ever stronger. People in these communities will increasingly have access to a diverse range of financial services at low cost that build trust and circulate capital within the community. They will also be able to use the Kora Network as a gateway to value-added services like marketplaces, education, loans, insurance and healthcare. Kora will create equal opportunities for everyone to join the world's economy on their own terms, regardless of geographic region, gender, social class, or economic situation.

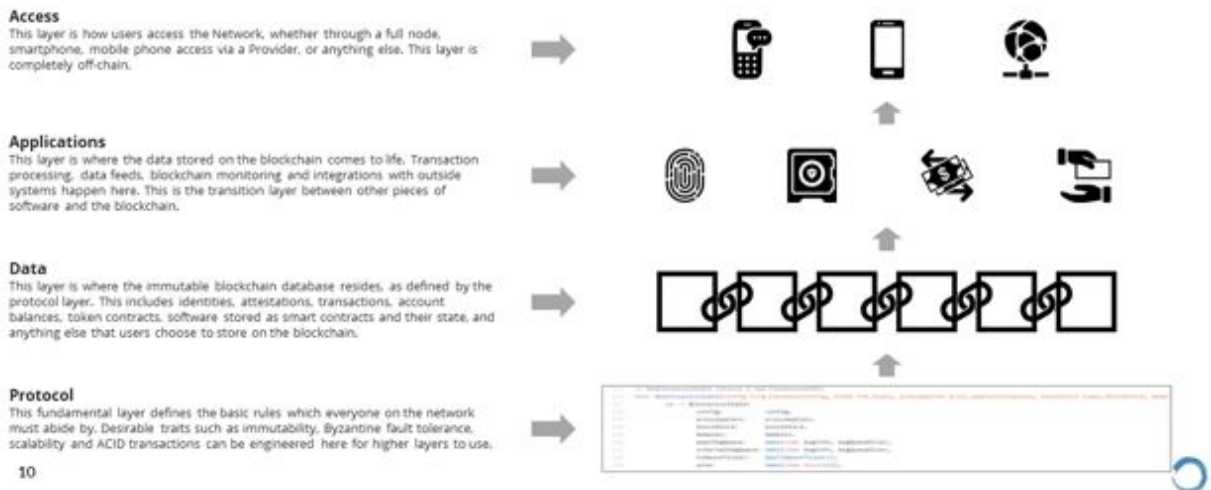
The Kora Network

The Kora Network draws on the model originally proposed by Ian Grigg in his paper “Financial Cryptography in 7 Layers”²⁵. The use of blockchain technology allows us to streamline these layers into four:

- **Protocol:** This fundamental layer defines the basic rules which everyone on the network must abide by. Desirable traits such as immutability, Byzantine fault tolerance, scalability and ACID transactions can be engineered here for higher layers to use.
- **Data:** This layer is where the immutable blockchain database resides, as defined by the protocol layer. This includes identities, attestations, transactions, account balances, token contracts, software stored as smart contracts and their state, and anything else that Users choose to store on the blockchain.
- **Applications:** This layer is where the data stored on the blockchain comes to life. Transaction processing, data feeds, blockchain monitoring and integrations with outside systems happen here. This is the transition layer between other pieces of software and the blockchain.
- **Access:** This layer is how Users access the Network, whether through a full node, smartphone, mobile phone access via a Provider, or anything else. This layer is completely off-chain.

Four Layers of Financial Infrastructure

We build on the model originally proposed by Ian Grigg in his paper “Financial Cryptography in 7 Layers”.



²⁵<http://iang.org/papers/fc7.html>

The Kora Network will be a platform that provides people, merchants, organisations, and other financial bodies to provide financial services in a cheaper, faster, and profitable way with the ability to reach Users worldwide. The Kora Network itself is not a licensed financial institution nor do we provide these services ourselves. Any Users wishing to provide financial services including accept and issuing tokens on the Kora Network should be a licensed financial services provider or mobile money operator. Providers are also responsible for meeting all KYC/AML requirements and onboarding Users accordingly.

Aside from these layers, which are rigorously defined in code, there exists a meta-layer of **Governance**. We believe a key competitive advantage of decentralization is the potential for decentralized governance, as a platform that is incentivized to maximize value for all participants will result in a more equitable deal than a platform that is designed to enrich a centralized counterparty. Decentralizing governance is a complex task and area of active research. For this reason, in the initial stage the Kora Foundation will be a centralized counterparty that makes decisions on behalf of the Network, in consultation with every stakeholder in the Network.

The most important stakeholder group is the participants on the Network. For major decisions affecting the Network, participants will be polled, with voting power measured in principle through contribution to the Network. Initially this measure will be the amount of KNT utilized in a sliding window of time, including eFiat that has been converted to KNT. Other stakeholders include national governments, financial institutions, NGOs and other parties who are affected by the Kora Network, whose views will be circulated through regional forums and coordinators at the Kora Foundation.

These inputs will be made public and used by the Kora Foundation for making decisions on the Kora Network. While this is a long way from fully decentralized governance, it does introduce a feedback loop where unpopular or self-serving decisions from the Kora Network can be recognized by all stakeholders, and their decisions to deepen or reduce participation in the Network adjusted accordingly.

Network Architecture

The Kora Network is built on Ethermint, which implements the Ethereum Virtual Machine with Tendermint consensus. We chose Ethermint because it supports the Ethereum development community, which is among the largest in the blockchain space, while also fulfilling each of the below vital network requirements:

- **Scalability:** Can process bank-scale transaction volume with reasonable latency.
- **Programmability:** The ability to build (mostly) arbitrary programs on top.
- **Resilience:** Should continue to function in a Byzantine environment.

- **Decentralized:** Network can be run in a decentralized manner.

The actual network architecture owes a huge debt to the design of the Cosmos Network²⁶, as well as the Delegated Proof of Stake (DPoS) consensus algorithm originally proposed by Bitshares²⁷. Providers read the blockchain and write to the transaction pool. Users can also read/write directly from the blockchain, so long as they are able to run a full node, meet regulatory requirements and have sufficient KNT to pay for transaction fees. Alternatively they can use a Provider to access the blockchain without holding KNT or running a node, but potentially with higher fees.

The Kora Network will be secured with a modified version of DPoS, where users who have staked the native cryptocurrency Kora Network Token (KNT) delegate their stake to candidate block producers. Of these candidate block producers, the top n are selected via a voting process to take turns selecting transactions to create, propose and vote on blocks that are added to the blockchain via Tendermint consensus²⁸. Each block producer puts up collateral in KNT as well as having KNT delegated to them. Previous examples include Bitshares, where block producers post a small bond equal to 100x the average pay they receive for producing a single block²⁹, and Dash masternodes which require collateral of 1,000 Dash, or between \$200k - \$500k³⁰. If block producers act maliciously, their collateral is slashed, and users may delegate their stake somewhere else. Block producers receive a reward for their contribution to securing the blockchain. The reward is paid in two ways: transactions fees collected from the block produced and at a rate previously set by the block producer, and inflationary tokens from block rewards. Block rewards are also paid to the delegators who have staked their KNT, and are divided among the block producer and delegators by percentage staked. For instance, if a block producer had 10% stake and the users had 90% stake, and the block producer charges a 10% fee, then out of a 100 coin reward the block producer would take 10 coins as the fee, and the remaining 90 would be split 10/90 between block producers and delegators. Only users who stake their KNT will receive a portion of the block reward and transaction fees.

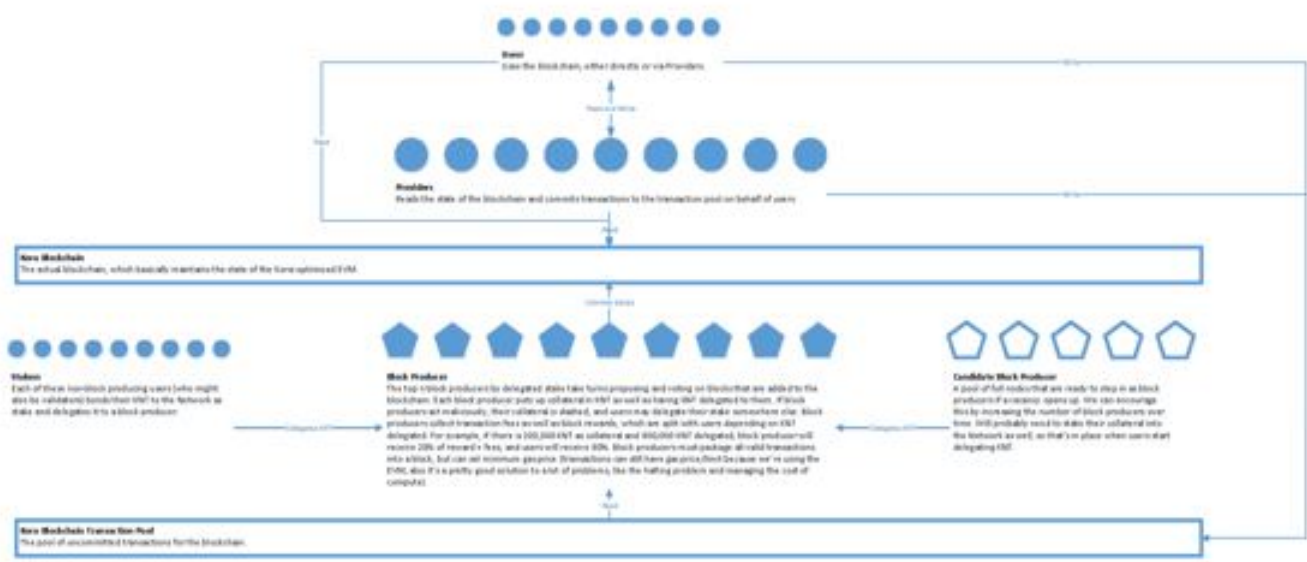
²⁶<https://cosmos.network/>

²⁷<https://bitshares.org/>

²⁸<https://tendermint.com/>

²⁹<http://docs.bitshares.org/bitshares/dpos.html>

³⁰<https://www.dash.org/masternodes2/>



As block producers are selected by the community, the expectation is that they will compete to be selected by publishing their hardware and network specifications. Only the block producers with the best specifications and highest uptime will be selected. In this way we can reliably produce large blocks with significant amounts of transactions in a latency of 3-5 seconds, leading to the level of scalability required for the relevant use cases. Further scaling can be accomplished via sharding, as we spin off new blockchains with different sets of block producers to easily double our throughput. However, this will also come at the cost of security, so sharding must be done carefully and with ample testing.

Finally, Ethereint integrates natively with the Cosmos Network, which is building an “internet of blockchains” that connects disparate chains together in a decentralized manner. By integrating with Cosmos, we will be able to connect with Ethereum, Bitcoin, the Cosmos decentralized exchange and various other Cosmos “Zones”, making the Kora Network natively interoperable with other blockchains.

Kora Network Token (KNT)

In general, cryptocurrencies are cryptographically secured stores of value maintained via a decentralized network. They differ from the currently dominant form of currency, fiat currency, in a few ways. First of all, where fiat currencies are secured through methods like anti-counterfeiting measures on physical bills, cryptocurrencies are secured by using public and private keys to encrypt and decrypt information in the network. Second, where fiat currencies are usually issued through a central bank, cryptocurrencies are issued and circulated entirely on a peer-to-peer basis. No one party is able to control the currency.

There are a three main types of cryptocurrencies:

- **Currencies:** The first use for cryptocurrencies was simply as digital currency. Bitcoin is the most well-known version, along with newer currencies like Litecoin, Dash and Monero. In Bitcoin, transactions are stamped onto a single ledger without a central authority. This is shared with very entity in the network, and everyone in the network can check if future transactions are valid or a suspect of double-spending. The use for these currencies is the same as any fiat currency, as a store of value and a medium of exchange. They retain and grow their value through the ability to fulfill these functions securely and without a centralized controller.
- **Utility token:** A utility token is a cryptocurrency that has a use in the network beyond its monetary value. Users can redeem the products or service via a combined public and private key, and this redemption value gives tokens inherent utility. There are a few different kinds of utility tokens:
 1. **Usage token:** A usage token provides access to the digital services that a decentralized blockchain network offers. The fundamental value of usage tokens is determined by the utility and the uniqueness of the capability underlying the digital services, such as Ether (ETH).
 2. **Work token:** A work token enables token holders to contribute work to a decentralized network, in return for a reward for the work that ensures the whole system functions properly, such as Augur's Reputation (REP)³¹.
 3. **Hybrid token:** A hybrid token is a combination of usage token and work token. Filecoin (FIL) functions as a usage token when token holders need FIL to use the decentralized storage system, and as a work token when one needs FIL to contribute storage space to the system.
- **Crypto Assets:** The third main kind of token is crypto assets. These are simply tokens that can be redeemed for an underlying assets. Good examples are Tether (USDT), which can be redeemed for US Dollars, or Digix Gold Tokens (DGX), which can be redeemed for gold.

KNT will be used as the staking mechanism for selecting block producers, as well as a single medium to pay for costs incurred by the Kora Network.

KNT must be staked by users as well as put up by candidate block producers as collateral in order to become a block producer. In return, block producers collect transaction fees as well as block rewards, which are split with users depending on KNT delegated. KNT preserves the gas and gas price mechanisms of Ethereum³², as it has proven to be an effective solution to the halting

³¹<https://augur.net/>

³²<https://ethereum.org/>

problem. Block producers must package all valid transactions into a block, but can set minimum gas price. As the lower bound the gas price block producers can support is equal to the cost plus a profit margin, block producers that can minimize their cost to support the lowest possible gas price will generate higher per-block transaction fees for their stakers, incentivizing block producers to optimize their operations and lower their minimum gas price.

Another, more minor use of KNT is as a “bridge” currency between eFiat currency pairs and other decentralized currencies. For n currencies, maintaining bid/ask exchange rates between all currency pairs would require $2 \cdot (n - 1)^2$ exchange rates. By simply maintaining exchange rates between each currency and KNT, we reduce this to $2 \cdot n$ exchange rates. As KNT will be maintaining exchange rates with other cryptocurrencies, it can also serve as the “hub” where eFiat can connect with the cryptocurrencies needed to run the decentralized stack.

Some work by Paul Sztorc indicates that in order to secure a blockchain network, the “lost effort should always equal the value released”³³. While Tendermint consensus does not require the “wasteful” burning of electricity that proof of work requires, it would be naive to assume a dedicated attacker would not hunt for other attack vectors. A more rigorous exploration of how to secure the network is a non-trivial topic and outside the scope of this paper, however it does indicate that all members in the Kora Network would benefit if the overall “value” of KNT (as defined as all issued KNT multiplied by price per token in USD) were maximized, while adjusting cost of accessing the network via the gas price.

³³<http://www.truthcoin.info/blog/pow-cheapest/>

Unlocking the Long Tail

By providing low cost, universal access to financial services, the Kora Network unlocks the Long Tail of the global economy in the form of the the capital, intellect, and creativity of the underserved.

Money Transfer and Payments

Currently, if a User in London wants to send money back to their mom in a village in Malaysia, they have to go to a Western Union in London, which takes 8%+ fees. Then their mom has to go or send someone to travel 2-3 hours to the nearest place to pick up that cash.

At Kora, the User will simply text/USDD Kora to send that same cash from their mobile account. That cash can be deposited via bank transfer, crypto transfer, or converted at any local Kora agent, where the broker converts fiat currency from and to electronic cash. Their mom walks down to the local Kora agent at the convenience store and picks up the cash. The User pays the network fee, and pays the broker a small percentage to compensate them.

The User has saved on both transaction fees and the need to travel, and the capital is kept within the local community. Later this transaction history can be used as proof of funds if the mom has to take out a loan. To the owner of a local convenience store, who is already familiar with cashflow liquidity from managing their inventory and has long-running relationships with the majority of the community, Kora lets them receive electronic cash denominated in their national currency, and to convert it to and from fiat currency. This provides a valuable service to the community, a new revenue stream, and a way to utilize excess cash.

Furthermore, the User will also be able to make basic payments such as mobile airtime top-up, mobile data subscription, paying bills and paying merchants, as well as for 3rd party services such as for energy, education, micro insurance and other use cases.

Lending and Loaning

Currently, if a user in Botswana wants to take out a loan from the bank or another lender to start a small or medium scale business, the user needs to provide multiple forms of ID, must be educated enough by the standards of the bank or lender, must provide previous statements of accounts for a minimum of one year, must provide valid business registrations from a centralised operator and signed referrals who have sufficient verified balances. They must also provide collateral worth more than the amount being loaned, and if they're acquiring property, it must be located in major cities where the land can be easily used as collateral in case of a loan default. **Essentially the user needs to prove that they don't need the loan in order to qualify for a loan.**

At Kora, the User will simply sign up and transacts using Kora to build credit history, and either engages with existing Community Value Networks to obtain a loan in a peer-to-peer process, or obtains referral and attestation from the Community Value Network to qualify for direct loans from the Kora Foundation as well as various other forms of loaning services from 3rd party integrations and ecosystem support.

On the flip side, Users from the global economy or from the Community Value Networks who have accumulated enough capital in the community and want to become a lender to support social good or to make a profit can easily do so by registering to the Kora Lender Service. The Kora Network provides a marketplace of peer-to-peer lenders and loaners as an additional set of lenders that breed competition and ultimately produce the most cost-effective loans for the User.

Agriculture

Across Africa, farming and agricultural activities are predominantly conducted in the rural areas. These rural areas are characterised with a high density of unbanked people, and most transactions are cash-based through every step in the supply chain. Large corporations receive their agricultural supply and raw materials from local farmers for processing to finished goods, but the farmers are not paid until after 3 - 4 weeks of supplying. Because they have no bank account, their counterparties have to take time working out how to distribute cash to them.

Additionally, many large corporations receive supplies from child farmers within this region just to meet up with the demand of the processed goods. Applications for loans by farmers are very difficult in the region because of the uncertainty of the nature of the business and, creating difficulties for the farmer in ensuring that his farm would yield the expected amount of harvest to repay the loan.

At Kora, the farmers will sign up on Kora and corporations would link every supplier of farm products to their Kora wallet. Supply of crops and payments of farmers by corporate market purchases would become seamless and the farmers get paid within minutes after products are supplied.

Through the farmers Community Value Network, each farmer builds his reputation by transacting with other stakeholders within and outside his network and builds a credit history and reputation. They can also seek attestation from the Community Value Network to verify that they are not using children for labour, and that they meet the standards for crop production and sales as defined by the community.

This identity automatically qualifies the farmer to access loans from the community, governments, agricultural organisations and NGO's as well as individual peer-to-peer lenders. Through the integration of our 3rd party services like **Gnosis**, farmers can better predict, plan, and make smart business decisions through the help of machine learning and business intelligence. Farmers can also receive digital education on farming best practice for optimising production from digital education

services on the Kora Ecosystem, and share the use of tractors or other machinery through the sharing economy.

When the time comes to sell their products, farmers can tap into a marketplace for producers and consumers built into the Kora Network, in order to match the farmer to consumers or potential organisations needing the farmers products across the world and give all parties access to optimal prices.

International Distribution of Funds

One of the greatest challenges of international aid is the massive corruption in the funds movement from NGO's in developed countries to people in need in developing countries. For instance, an international aid organisation funds a vaccination project for \$1m by sending to the country in need. The chairman from the government arm confirms receipt of \$1m but sends \$900k to the Ministry of Health, the Secretary of the Ministry of Health takes some for himself and his cohorts and sends \$750k to the deployment team, the deployment team project lead inflates the project and pockets \$50k. At the end only \$700k truly gets to the user in need. This is one of the main reasons international aid is inefficient for quick relief of victims in these regions.

For humanitarian missions, every User in the country that's affected can be given a humanitarian Kora account which enables the User to receive transactions with vouchers that allow them to access multiples services through SMS/USSD or mobile app.

The international aid organisation would distribute funds directly to its Users on the Kora Network via a smart contract that does not permit the funds to be transferred or spent anywhere else except accredited health care provision centres in the relief zone. The progress of the funds will be monitored with exact statistics of when, how, and where the User used the funds, hereby eliminating the need for 3rd party intermediaries in funds distribution as well as ensuring proper tracking and monitoring of funds since every transaction on Kora is on the Blockchain.

Pre-approved Users in various plagued regions around the world could access the Kora ecosystem for funds distribution from private and institutional donations.

Conclusion

The success of the Kora Project will be a milestone in the long running quest to alleviate poverty for billions of people and to let everyone share in the wealth created globally. It will also be a landmark use of blockchain technology for social good to foster prosperity. The success of this project could be the hope of financial freedom, empowerment, and wealth redistribution to the millions in deserted, economically unprofitable regions of the world.

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