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Loanchain Protocol

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Project Group: Social Capital and Blockchain

Loanchain Protocol

(Decentralized credit scoring for new borrowers using social capital)

The Loanchain protocol creates a decentralized incentive mechanism to help create digital individuals from low economic backgrounds gain trust by creating digital identities and social credit scores.

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Background

The report tries to address a premise that there are many people in remote areas/ from economically weaker sections who are creditworthy. Latest world bank data shows that over 3 Billion people around the world remain unbanked. The unbanked do not have adequate availability to formal means of finance and many people do not have records that allow them to prove their credit worthiness. It is a known fact that financial inclusion uplifts the quality of life of people and increases their opportunities to gain livelihood. However, the current methods of finance are not suitable for people from low economic backgrounds and many first time bankers/borrowers. The preponderance of technology, mobile phones and internet has created new means to onboard people who have not been able to participate in the formal economy so far.

Overview

The Loanchain whitepaper introduces a decentralized protocol for solving the challenges of onboarding people from economically weaker sections onto a digital platform.

The Loanchain Protocol uses a existing methods and research on social capital and creditworthiness assessment through social and alternate data to create a credit scoring mechanism for people without credit scores. The protocol also creates a framework for participation of social network peers and community members to contribute towards the scores and ratings of individuals. In affect , the Loanchain protocol leverages the wisdom of communities to assess people creditworthiness and creates incentive mechanisms for appropriate ratings as well as monitoring mechanisms for enabling financial transactions. The decentralized system can alleviate the problems of low penetration of centralized credit agencies and information repositories.

Loanchain Protocol creates the following

1. Verified digital identities for people without identities
2. Social capital based credit scoring mechanism to assess credit worthiness of individuals
3. Self-soverin identities for individuals to share data without compromising privacy
4. Decentralized data repositories for easy data sharing and interoperability.

The Loanchain Protocol

The Loanchain protocol uses the following heuristics for estimating Social capital

1. Every person in society has people who trust them. The more people who trust you, the more trustworthy you are within your community.
2. Community members - including neighborhood retailers, village level leaders and social sector participants - continuously assess behaviours of people they meet. Such assessment can serve as a proxy for creditworthiness. The more such people who vouch for you, the more trustworthy and creditworthy a person is.
3. Mobile phone call records provide a sense of community membership of an individual and can be used to measure trust and create a proxy for creditworthiness.
4. Group participation and activities create a form of peer pressure for individuals to perform on their assumed obligations. This has been demonstrated in the social lending model of Grameen Finance and Micro-Finance Institutions which have had historically high repayment rates for their loans.

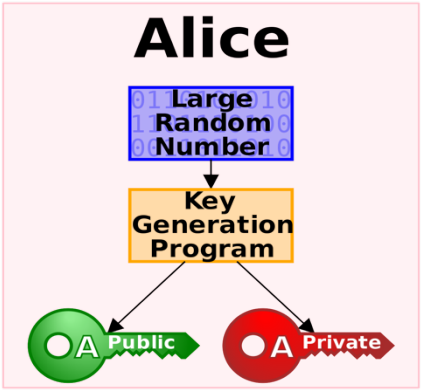
Enrollment and Identitity Verification

The First step in the LoanChain models involves the creation of a digital identity for an individual. This requires offline verification.

In the Loanchain model, the user visits a nearby retailer to purchase a mobile top up card (mobile money) or a mobile smartphone. The retailer has already been enrolled into the Loanchain program and has a defined set of procedures to follow to onboard the individual into the LoanChain Identity Management system (IDMS). The retailer does the following

1. Click an image of the individual
2. Ask individual to add a digital image/biometric signature to the image.
3. Verify the Identity document of the individual and attach an image of the same to the IDMS

The IDMS conducts an intelligent verification of the ID document and image uploaded and creates a new verified Digital Identity of the individual. The IDMS thereafter assigns a Private Key to individual which can be used by the individual along with the biometric marker to access all personal records and control the IDMS permissioning system.

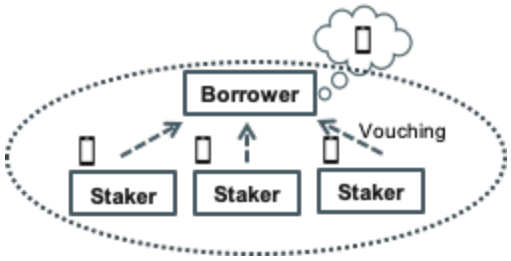


LoanChain Mobile Interface

Loanchain uses a peer-peer staking and community-staking model to assess the social capital of the individual. The individual, once having created an id on the IDMS, is provided information about the credit scoring methodology by the retailer. The individual must download the Loanchain Mobile App (LCMA) to access personal information and join the credit program. The LCMA has the following features

1. Peer vouching : The individual can send across a request to his peers for vouching , mentioning that they trust the individual.
2. Merchant approval : The individual can send across a request to his merchant for vouching , mentioning that they trust the individual.
3. Additional Data : An option for individual to submit records of any additional data - thri party scores, electricity bill payments
4. Request for Loan : The individual may place a request for a loan in a simple loan format
5. LC Wallet : Controls FLow of LC Coins and Loan Dollars. It also serves as medium to collect payments and make payments.
6. Vouch for peers
7. Vouch for community peers
8. Transaction records data
9. Reminders and other information

1. **Peer Vouching**



There is substantive evidence that peer networks are able to assess a person's creditworthiness. A peer vouch acts as a signal of social trust and creditworthiness. The more such peer vouches, the higher the social trust. Also, the higher the social trustworthiness of the voucher, the higher the trustworthiness of the person being vouched. The number of vouchers and quality of the vouchers will contribute towards the peer score of an individual. Measures of such peer scoring are indicative and not absolute. Such measure of peer vouching are not absolute and must be interpreted in context with the purpose of use. For example the same peer vouch score will be interpreted differently for a $100 loan versus a $5000 loan. However, peer vouch can serve as an important signal for the credit score of an individual.

2. Merchant Approval

Merchants in different communities play the role of market makers. They often have to provide soft loans and supply goods on credit. The cash flow of such merchants depends on the nature of goods they deal in and their working capital cycle. Such retailers are often capital constrained. However, they have a history of being able to make credit decisions and are often in the business of providing credit. Providing credit can help them increase their sales and profitability , however they are limited by their capital constraints and ability to scale business - product sales and lending. The LC model relies on creating incentives for such merchants to participate in the model to verify and attest the initial creditworthiness of individuals. The attestation records of merchants are tracked for rating and verifying merchant performance and data authenticity.

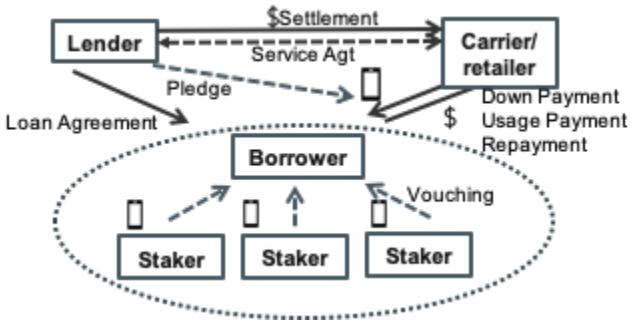
3. Additional data

The individual has an option to release additional data such as mobile data through this feature. The individual can also upload copies of other transaction records, certificates through this feature. This individual can also send requests to third parties for verification through this feature. This feature allows individual who already have records to onboard their existing records on the platform.

4. Request for Loan

This feature provides an opportunity for an individual to request for loans. The individual can use the application permissioning system to release verified IDMS data to potential lenders and data verification agencies.

In order to perpetuate the Loan System and initiate the credit system running, the LC protocol relies on creating small ticket loans for purchase of smartphones. The nearby mobile retailer will be the merchant attester in this case who can be used for the IDMS onboarding and initial attestation. LC will work with Incubed and Slock.it to create digital IOT based locks. This lock will be downloaded onto the phone , run on a smart-contract. The Digital Lock will ensure that the mobile phone can only be used when loan obligations are paid on time. Should there be a default in loan obligation, the digital lock automatically locks the mobile phone from usage. The mobile phone functions as a movable collateral and the digital lock creates a deterrant from defaulting repayment obligations. In the initial phase, the borrower will have to put a 30% down payment on the purchase of phone further skewing aligning the repayment incentives of the borower.



5. LC Wallet

The LC wallet serves as a means for excahnge of tokens, access to money , digitizing payments and provides means to online repayments of loans. The borrower also has an option to make offline repayments to the merchant and receives a mobile confirmation of the payment.

6. / 7. Voucing requests

The borrower has option to put up vouching requests. The request feature makes use of the IDMS to assign unique verifiers to vouches. Such unique verifiers will ensure that detection of multiple ID creation by the same individual.

8. Transaction information
This feature allows individuals to release verified transaction attributes to third parties thus creating a permissioning system wherein an individual has complete comtrol of information being released.

9. Reminders and other information

This feature acts as a method of private communication between lenders and borrowers.

Blockchain Framework

Loanchain Tokens (LCT) will be created on the Ethereum platform and utilize the ERC 20 token standard.

LC protocol requires ensuring the identity of participants, creation of algorithms for social capital through mobile data, peer stakes and intermediary participation. The LTC tokens will be used to create incentives for peer staking, intermediary participation and network management. A tokenized free market of incentives is best to ensure the network management.

Intermediaries and Participants

Intermediaries such as retailers are required to extend the last mile loans and ensure disbursement in the current environment. It is important for the intermediaries to be incentivized for adequate performance. LCT will be used to create a free market incentive system. In addition the network will maintain records of the intermediary performance to assign a quality score to the intermediary based on the performance of the loans disbursed through the intermediary.

Other network participants will include third party data providers, loan vaildators and other lending agencies with data. LCT will be used as the incentive system for them in the same manner.

Borrower stakers and peer reviewers
Peer reviewers of borrowers need to be rewarded for accurate peer reviews and for the performance of the loans. Based on the loans availed by the borrower and the peer review

systems, LCT will be used to reward reviewers on timely loan repayments by the borrower and also for continuously monitoring the performance and behavior of the borrower as per the social review system.

Initial Coins usage and Network costs

For starting off the system, an initial set of retailers will be selected and physically verified. They will be briefed of the products and the lending systems and methodologies for offering loans. Each loan originated will lead to creation of LTC and successful loan closure will trigger the payment by lender in the form of LTC. LTC will be used as payoff for members in the information network who have enable such loans to take place.

Credit Scoring Algorithm

Blockchain for Data Portability and DiD based Borrowing community management

The credit scoring framework will be used to rate users on a 0-100 scale and take into account the following

Peer score

1. Number of peer stakers - 1 point for a new staker / 2 points for a validated staker
2. Minimum three stakers required for validation

The maximum staking points that can be accumulated are 20.

Data Score

1. Mobile call/usage records
2. Social data
3. Other existing records

Measures based on mobile and socially generated data will be used to allocate the balance additional 50 points.

Third party score and Identity verification

External agency confirmation will be used to ascertain the remaining 30 point.
The involvement of the third party ensure that there is identity verification and also adds a confirmation layer on social reputation. The understanding here is that market participants in such communities have alternate sources of information and can gauge the reputation of individuals based on soft factors such as behaviors, social standing , ethical reputation etc.

Transaction data - Credit records

1. Transaction data on system
2. Alternate transaction data including electricity bills, school fees, other payments.
3. External loan records

Transaction data will be used to ascertain the credit limits of the person.

The credit scoring algorithm needs to be trained based on the records of loans and performance of loans. While the above data points will serve as inputs and create the initial basis of the credit score model, the credit score model will have to be continuously updated based on updated models of creditworthiness that will improve with data access.

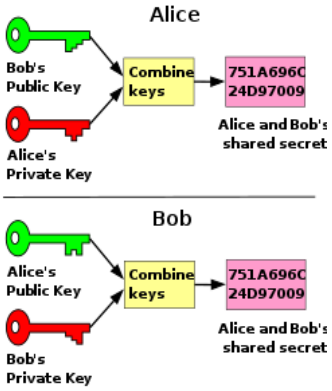
Payment monitoring

Loans and repayments are an ongoing process. Social lending thrives on peer pressure and ongoing payment monitoring. The Credit scoring Algorithm will have built in incentives for peers (It affects the credit scores of the peers) to monitor the timely payment of loans by borrower, thereby having the elements of social pressure. Feature 9 will be used for the same.

IDMS

The IDMS will create a mix of public keys and private keys.

Users will have the option to utilize the private keys to release verified claims to individuals and organizations in the event the require to do so.



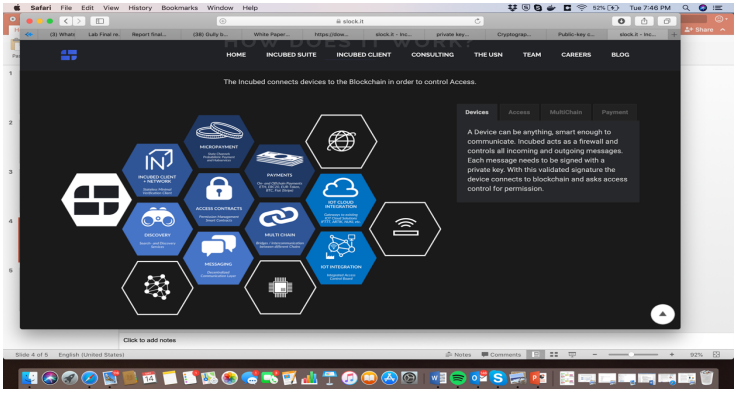
The IDMS will utilize the public and private keys to monitor the permissioning system. The IDMS ensures that in call cases individuals have control over their data and have the option to easily release verifiable data as and when required.

Digital Locking System and E-collateral

The Loanchain protocol is initially aimed towards first time borrowers. Appropriate checks and balances need to be maintained to ensure that these borrowers are reminded of their payment obligations and the consequences of not paying their obligations. In such a network, it is at times important to take necessary steps that act as deterrents and prevent loan defaults in other for the system to be successful and have greater reach.

The loanchain protocol works best when the initial loans are made against electronic goods that can be attached to a digital lock. The digital lock will be connected to the Blockchain network. In case of default in loan obligation payment, the digital lock locks the system and prevents the usage of the machine until the payment is made.

We intend to use Incubed services to ensure the Digital Lock.



Understanding attacks

Sybil attacks

The LC protocol is susceptible to Sybil attacks. Users may setup virtual merchants who can approve unverified borrower and peers. This system can be used to create the perception of high social standing and creditworthiness in the system to access loans. Real users may also conduct transactions to win reputation to access greater ticket loans which they eventually plan to default upon. The LC protocol relies on merchants to seed the system. It is important to have a clear set of verified guidelines to onboard initial merchants who are of high reputation. With initially verified merchants , the LC protocol will rely on a verification chain thus limiting the creation of a new network of merchants/borrowers/peers who have no connection with outside system. In the event of such creation it will be detectable as a separate node having unique edge that have no interconnection with other edges. In addition the use of mobile app requires mobile phone/ number linkage which increases the cost of creating new users. The network also requires biometrics in the IDMS and creation of new unique biometrics/ face IDs will prevent the instance of Sybil attack.

Conclusion

The Loanchain protocol v1.0 is aimed at solving the problem of digital identity creation and small ticket loan distribution in an efficient manner. It is also an efficient method of data portability and interoperability. In the first phase the Loanchain Protocol will be tested with a set of 10 merchants across its range of features. Loans, initially given for mobile phone purchase will go on to purchase of other digitally lockable electronic products such as tractors, hand pumps and communication tower equipment. This will subsequently lead to model upgradation and Loanchain v2.0

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Appendix – Background research and process at arriving at Loanchain Protocol
(The appendix is additionally provided so that it can serve as background research for another team planning to pursue research on the Loanchain protocol with NRIA)

In this report, we identify and analyze a use case for leveraging individual social capital for transaction. We work on a high-level framework using Blockchain based multi-phase microfinance lending system in which rural farmers can avail small loans to purchase mobile phone and [agricultural inputs]. The idea is to bring farmers, suppliers and financiers on a single platform and create trust within the system through a social reputation scoring model for the farmer. In addition transactions can be facilitated by using technology to ensure privacy while at the same time create access to new modes of collateral such as mobile phone and farm inputs. Blockchain technology enables exchange of information among borrower, mobile supplier, and lender, and accumulation of economic and non-economic data associated with mobile usage, and helps expand the use of the data such as secondary sale of the loan or [forming SHG with other people in the system]. It will also be used for time-stamped data for loan performance monitoring and create information accessibility to all parties concerned.

Our proposed framework is as following:

Key idea:

A. Providing loan to purchase mobile phone
B. Using credit score to provide additional loans

Key characteristics behind the idea:

A. Building social reputation score of individuals through mobile data
B. Community of borrowers/guarantors to create social loan repayment obligations
C. Participation of Retailers/ Mobile carrier networks to monitor identity and act as agent for loan/good disbursements.
D. Technology to e-securitize the good being disbursed to create a new collateralize good and manage borrower incentives.
E. Blockchain layer to record transaction, manage Digital Identities, create verifiable claims/attributes and also a permissioning system.
F. Transaction monitoring through new e-collateral.

The objective of our project was to come up with an economic use case for social capital and was also to find ways in which Blockchain can be used in the real world for transaction, which Nomura Research Institute ("NRI"), the partner company of the project, has been seeking. We worked on frameworks to understand social capital, Blockchain technology and also how finance lending takes place in developed economies. We identified a significant problem in developed economies - one of low financial inclusion of people from economically weaker sections, combined with low income and poor means of finance for such citizens. New ways of measuring creditworthiness, trustworthiness and practical applications of Blockchain have the power to address the problem and enable finance for many more people. We analyzed and assessed the question "can we create a system of loans and credit scores for people without bank accounts/ sufficient financial history" and applied a method of iteratively asking questions followed by research and interviews to come up with solutions. The final question we seek to address is "can we create an incentive system driven by blockchain technology to help utilize digitized social capital, quantified through accumulating mobile usage data, develop trust within community to drive new transactions".

NRI has been conducting a research on social well-being and associating it with human behavior in today's society surrounded by digital devices. In the study, NRI has developed draft system architecture for collecting mobile data which functions as a proxy to human interaction in a community. They expect the research will be contributing to development of new system which makes social capital quantifiable and tradable as an alternative measure for economic capital which is currently the dominant objective criteria to evaluate people's well-being.

As we walk through topics relevant to social capital such as social score or peer-to-peer lending, we identified that Blockchain features such as transparency, low transaction cost and immutability could effectively expand the opportunities of micro-finance lending system by eliminating its dependence on personalized and on-site interaction which makes it difficult to reach to remote areas and causes "single point of failure" risk. We also expect that the use of mobile device is a unique driver of the proposed system as the devices can be served as security for loans. Our idea is to combine incorporating traditional micro-finance lending system and .

2. Social Capital, Credit Score and Information Technology

While the concept of social capital has got huge attention in recent decades, it has existed since long ago. It comes from attempt to account for ties of people within a social unit as tangible

assets. Social ties are assumed to be generated from direct or indirect human interaction or a set of social behavior based on common understanding or shared norms which community members expect from each other. OECD defines social capital as "networks together with shared norms, values and understandings that facilitate co-operation within or among groups". In this way, we can think of networks as real-world links between groups or individuals, networks of friends, family networks, networks of former colleagues, and so on. On the other hand, social norms are less concrete than network as they may not be apparent until they are broken. To this point, we may be able to think that predictable social behavior arising from reciprocal relationship or sence of mutual support is the value which underlies the social norms and accordingly regarded as source of social capital.

Since people in a community with rich social capital have access to support from others and live with sense of security and belonging, the social ties can be regarded as something valuable which people can potentially claim. Also, it is not too speculating if we assume that people serving in a positive loop of creating social capital are trustworthy regardless of their economic status as they are thought to be sensitive to peer pressure, eager to meet social expectation, and accordingly less likely to break rules.

Considering these characteristics, application of social capital in a real world has been studied with various desires such as to provide a measure to evaluate human well-being instead of economic power, or to empower people in developing countries by monetizing their trustworthiness as security for loan which is in fact realized in micro finance lending.

Nowadays, these attempts have been seen more frequently in business fields as the expansion of social attention to economic inequality in the developing countries, which is encouraged by rapid advance in data technology which enables collecting, accumulating, and analyzing enormous data about human daily activities from various sources. Especially, mobile phone has a big potential because if usage data can be analyzed not only qualitatively but also qualitatively it may be possible to formulate trustworthy of personnel in the context of social capital he or she is associated with.

One potential application is lending. In the lending business, the importance of evaluating people's borrowing capacity from various aspects has been always emphasized. However, credit scores largely depended on past financial history, salary, property, or collateral value, and not focused on people's willingness to repay, because standardized way of scoring people's behavior has not existed. Tala, a fintech startup providing instant micro loan through mobile app by giving credit score based on payment history, identified meaningful correlations between people's certain social behavior observed by mobile data and lower rate of default they performed at in repayment. For example, borrowers who contact regularly with specific people (consistency in key relations), use mobile at consistent pattern (stability in location), or keep in touch with

diverse people (Network diversity) have been less likely to default. We assume this fact can be a proof that credit score is able to be derived from social capital through aggregating and analyzing mobile data.

3. Micro Finance with Social Capital and its Challenge

Banking plays an important role in the development of an economy. Over time , banks have assumed the responsibility of 'trusted third parties' enabling transaction in the economy. In addition they are important participants in credit markets enabling people and organizations to borrow money for investment and expenses. However, the absence of formal banking in many rural areas creates a need for financial inclusion of millions of people who have no access to formal banking channels. They rely on cash for transactions and Micro-Finance Lenders for finance. However, the problems of low access and inadequate information create market imperfections which has led to very high cost of capital in rural areas. Such high cost of capital is a bane on the development of people in such areas for whom the burden of servicing high interest loans is maximum.

Grameen Bank, founded by Muhammad Yunus in 1976 in Bangladesh pioneered a microfinance model that utilized group lending and social pressure for repayments. The group lending model overcomes individuals shortcoming by creating collective responsibility and security afforded by the formation of a group of such individuals. The collective creates educating and awareness and peer pressure amongst the individuals driven by an incentive system for group performance. This system was tremendously successful and resulted in extremely high loan performance rates in what was before considered as risky loans. In the Grameen Group Lending Model, small business owner or individual entrepreneur can get small loan by forming a Self Help Group ("SHG") in which members mutually guarantee the loan obligation while physically monitoring each other including consultation with service agent from bank.

To say nothing of, the idea of providing loan to person or group without proven credit history by leveraging on tight relationship within community has been common for hundreds of years. The most ancient way is Rotating Saving and Credit Association ("ROSCA"), in which group of people set a common fund and each of them contribute certain amount to the fund periodically, while one member at each time is allowed to borrow the lump sum from the fund.

The increased penetration of Microfinance comes with its own share of challenges.

1. Microfinance institutions used their accessibility power to lend at extremely high rates. Given low competition among microfinance institutions and low incentives of MFIs to lend in same villages, MFIs could utilize their bargaining power over borrowers to lend , often at rates as high as 100-150%/ year.

2. Microfinance institutions relied on loan officer to go to villages , create borrower collectives, conduct verification (Know Your Customer, or KYC) and acted as agents of cash disbursement and collection. They were sole agents of information between MFIs and borrowers. This creates a risk of 'single point of failure' for MFIs and is a significant cost factor for such institutions.
3. Scaling presence of MFIs requires them to identify, recruit and train and more loan officers who can access rural areas to create lending groups. This is challenging, time consuming and expensive.
4. Increase in loans by MFIs often led to poor lending practices, at times create high leverage among borrowers and subsequent inability of borrowers to repay. This is accompanied by repayment pressure and at times nefarious recovery tactics, leading to social disharmony.

We believe that to scale Microfinance, the problem of single point of failure, transparency in lending practices and prohibitive costs of creating collectives needs to be addressed.

On that basis, we have drafted a framework for microfinance using Blockchain to address the above constraints and further improve financial inclusion.

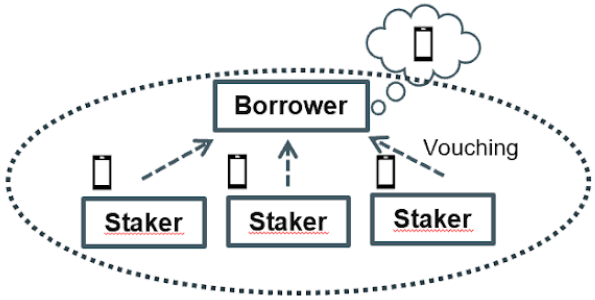
4. Use case Framework

In this section, we describe how the building of social credit works in the process of borrowing loan to purchase a mobile phone and how that system can be expanded to further lending applications.

4.1 Process of borrowing for mobile phone

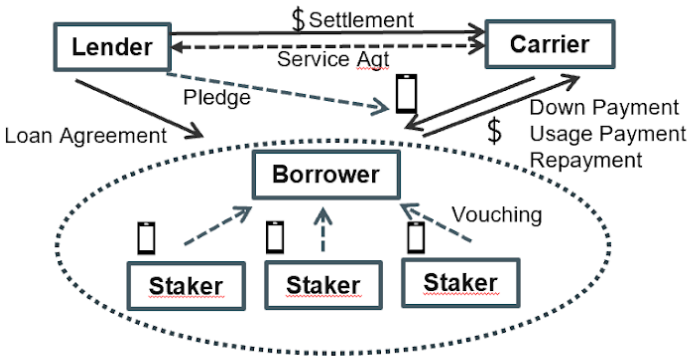
Now there is a person who wants to purchase a mobile to communicate with the members in the society, though he or she does not have a credit history. Since the borrower has neither credit history nor mobile data, lender cannot evaluate his or her creditworthiness in any way. To begin with, he needs to find at least 3 people to form a borrowing group. This idea derives from a SHG in Grameen Group Lending Model. The members of the borrowing group have to have mobile phone and verification of grouping is processed via online. From our discussion about social

capital in the section 2, we regard a person with allies from peers as a trustworthy person. Accordingly, The borrowing group is collectively responsible for the loan obligation.



After the borrower forms peer-to-peer network, the lender provides loan to the borrower, and the funds should be used to purchase mobile phone. The borrower only pay the down payment and the balance will be settled between the lender and the carrier. The borrower has to pledge the mobile asset to the lender. In principle, movable assets cannot be perfect security unless they are kept by the lender, but the idea behind this rule is that mobile device can be served as partial security because its usage or location can be tracked by carrier and mobile service can be suspended by the carrier.

During the repayment phase, the mobile usage data together with the payment record aggregated to the system will play a key role in monitoring, which is the critical part for the framework. In the traditional micro finance, bank agent visiting borrower has a lot of things to do such as continuously drawing sense of peer pressure to the borrower, finding out a sign of failure in payment, or providing support to the borrower as needed. The agent is expected to fix the problems to make sure that the system works in a desired manner. Our attempt is to replace this human intermediary with tracking mobile usage data and payment records.

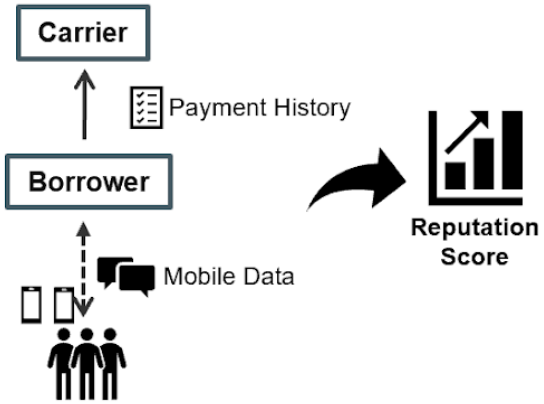


The main idea is to abstract metadata such as location, number of calls or texts, or type of messages from mobile data and adjust borrower's status depending on whether the observed behavior is consistent with what reinforces social capital or not. Such status is assumed to be expressed in a numeric manner as the complement to the credit history based on payment records. If a significant deviation in behavior which is expected to damage social capital is identified, the score is decreased and that triggers lender to take specific actions to prevent borrower's default. The actions are designed as substitute for what bank agent is supposed to do on site, but they take place through mobile communication; for example, notification to the borrower or members in the borrowing group (equivalent to consultation in SHG), or suspension of mobile service (equivalent to acceleration of collateral).

These monitoring activities are conducted by mobile carrier as a servicer of lender according to pre-agreed arrangement between them.

The benefit of digitized monitoring mechanics is not only to replace the human intermediary but also to aggregate the data: the borrower can build credit score in the system, a process accelerated by demonstration of good social behavior. The score mainly drives from payment history, but it is further adjusted by social behavior identified in mobile usage. Then the credit score can be applied to pricing model. Lender can offer loans at adjusted interest rate depending on the social reputation score.

We provide some basic ideas for mechanics of credit scoring as follows:



-Identifying common patterns in social behavior:

As discussed in Tala case, there could be commonality in behavior observed within people who have successfully performed payment obligation such as consistency in key relations, stability in location, or network diversity. By accumulating mobile data and borrowers payment records, more precise and personalized pattern can be created.

-Revealing creditworthiness through relationships:

This measure is suggested in the white paper of Bloom Protocol, a decentralized credit scoring powered by Ethereum and IPFS. The idea is to set creditworthiness of the group members as an anchor for the borrower's one, with assumption that "the financial history of their peers can be used as a heuristic and indicator for what patterns their own repayment behavior can reasonably be expected to follow (Jesse Leimgruber, Alain Meier, and John Backus, 2018, p5)". For example, if the members have build good credit history with specific financial activities such as not having missed any loan repayment, the lender can reasonably expect the same level of financial performance by the borrower even though he or she has not achieved it yet.

4.2 Further application

The lending system discussed in the previous subsection can be expanded by leveraging the application of blockchain; namely, providing decentralized ledger which multiple parties can access, recording transaction history, managing Digital Identities, and so on. The concept is to invite new stakeholders such as lenders and carriers to enhance market competition so that the

borrowers can reach to better service. Also, the borrower can form larger group with new people who have certain level of social credit to seek larger amount of loan for their business activities.

The purpose of loan can be wide, but e-secritalization can play a role in enabling the lending in this phase as well. The idea is to link mobile device with the asset purchased and take control of its utilization. For example, if the borrowing group seeks a tractor for their farming activities, lender can indirectly colaterize the vehicle by implementing lock/unlock control system by which the tractor can only be started after authentication through the mobile device. If they want funds for purchasing warehouse, it can also be pledged by using mobile key at the entrance which can be locked remotely by the carrier as needed.