Blockchain Uses for Microfinance Institutions in the Water and Sanitation Sector: Pilot Study

Authors:
Pedro Coli
Caroline Pflueger
Tyler Campbell

Editors:
Mauro Nalessio
Keisuke Sasaki
L. Javier Garcia

May, 2021
Blockchain Uses for Microfinance Institutions in the Water and Sanitation Sector: Pilot Study

Authors:
Pedro Coli
Caroline Pflueger
Tyler Campbell

Editors:
Mauro Nalesso
Keisuke Sasaki
L. Javier Garcia

May, 2021
BLOCKCHAIN USES FOR MICROFINANCE INSTITUTIONS IN THE WATER AND SANITATION SECTOR: PILOT STUDY

Authors:
Pedro Coli, Caroline Pflueger, Tyler Campbell

Editors:
Mauro Nalesso, Keisuke Sasaki, L. Javier Garcia
# Table of Contents

- Acknowledgements and Study Participants
  - Study Participants
- Executive Summary
- Introduction
- Water, Sanitation, and Hygiene in Latin America
  - Current State
  - Unique Challenges
- Microfinance in LAC
  - An Overview of the Industry
  - Access and Financial Exclusion
- What is Blockchain?
  - Evolution
  - Blocks and the Chain
  - Key Attributes of Blockchain
  - Configurations around Access and Privacy
  - Smart Contracts
- What is BanQu’s Blockchain Platform?
  - Do You See Blockchain Here? ™
  - A Proven Track Record
- Blockchain in Microfinance
  - A Natural Fit
  - The Power of an Ecosystem
- Pilot in Peru
  - Objective
  - Key Partners and Players
  - Area of the Pilot
  - Current Loan Cycle of Selected Microfinance Institutions
  - Operational Guidelines
  - Pilot Findings
- Conclusions
- Sources
Acknowledgements and Study Participants

The authors wish to extend special thanks to the individuals and organizations who made important contributions to the development of this study.

Study Participants

The Inter-American Development Bank (IDB), a regional multilateral development bank, is the main source of multilateral financing for economic, social, and institutional development in Latin America and the Caribbean (LAC). With the aim of improving lives, the IDB improves health and education and advances infrastructure through financial and technical support for countries working to reduce poverty and inequality. The IDB has been a pioneer in the promotion of microfinance in the LAC region. In the past two decades, the Multilateral Investment Fund, currently known as IDB Lab, has promoted the expansion of the main microfinance networks and has encouraged many innovations that allowed the development of this dynamic industry. The IDB funded this study and previously financed the CREDIAGUA project in Peru (2014-2016), which facilitated access to potable water and sanitation services for low-income populations in peri-urban areas by offering financing alternatives for sanitary improvements in homes.

BanQu, Inc. is a for-profit/for-purpose blockchain-as-a-service software company based in Minneapolis, Minnesota. BanQu provides a platform that enables supply chain transparency, traceability, and accountability through non-crypto blockchain technology while providing financial inclusion for the unbanked and underbanked of the world. BanQu aims to help lift 100 million people out of extreme poverty by 2023.

Water.org is a global nonprofit organization working to bring water and sanitation to the world. One area of their focus is making water safe, accessible, and cost-effective through affordable financing, such as small loans. The WaterCredit initiative helps bring small loans to those who need access to affordable financing, and expert resources to make household water and toilet solutions a reality. It is a pay-it-forward system that makes it possible to help more people in lasting ways.

Multiple Microfinance Institutions (MFIs) in Peru participated in various ways during the information gathering activities and in assessing, approving, and making loans to borrowers. In addition to the borrowers, the identities of the MFIs will remain confidential.
Executive Summary

Decades ago, the legendary science fiction writer, William Gibson, noted, “The future is already here – it’s just not evenly distributed yet.” With any technology advancement, there will be experts who develop a deep understanding of the technology’s functionality and capabilities. It takes partnership among these experts and the leaders in different industries to maximize the potential of applying new innovations to solve the toughest challenges. This pilot study brings blockchain experts together with organizations both supporting and directly administering microfinance loans for people seeking access to clean water and improved sanitation.

This study will test the hypothesis that blockchain technology has the potential to improve the efficiency of the existing microfinance model and promote financial inclusion of unbanked individuals. Therefore, one goal of this study is to contribute to an increased understanding of blockchain technology to Microfinance Institutions (MFIs) and key stakeholders in the microfinance sector. Another is to explore the feasibility of implementing blockchain technology into water and sanitation microfinance programs. A third goal is to illustrate how transparency, data democracy, and digitizing data capture and processes can strengthen and improve the existing microfinance model. This third goal occurs by protecting the rights and privacy of individuals, creating value for borrowers beyond the duration of a loan, showing the potential to decrease operational costs for MFIs, and securing impact data for donor organizations that support microfinance programs.

Beyond resulting in the writing of this paper, deploying a pilot provided real-world data and stakeholder feedback. Instead of conversations being limited to theoretical strategies, on-the-ground loan assessors and loan officers from the selected MFIs provided unique insights about solution design and configuration to meet their needs and challenges. Once the blockchain platform was deployed, those stakeholders registered prospective borrowers on the platform with necessary inputs and executed loan approvals or denials within the solution, and actual borrowers received loan communications secured with blockchain technology.

The pilot showed the potential of blockchain technology to improve institutional performance of MFIs and promote data ownership for the individuals (borrowers). Capturing and managing loans using the blockchain platform showed the potential to increase the efficiency of the existing loan process, and improvements to the Know Your Customer (KYC) process, while promoting an economic identity for the borrowers. In addition, the pilot showed how blockchain technology can support MFIs and microfinance donor organizations to monitor and verify the use of the loan for intended purposes.

While extending the study into a pilot allowed these advantages, one challenge of the study was the timeline. With only four months for the study, the duration of the pilot was much shorter than a complete loan cycle, which, in the piloted region, is typically six to 12 months from the date of loan disbursement.
Despite the limitation of time, this study met the original goals and provided additional validation beyond discussions and hypotheses developed in conference rooms, far from those who have the most opportunity to have their lives improved with innovative technologies. The pilot verified that blockchain technology has incredible potential in the microfinance sector, and additional studies are encouraged to further test and implement the technology for the complete loan cycle and develop cost-benefit analysis that can show MFIs the potential savings in operational costs by implementing the technology.
**Introduction**

This study explores how blockchain technology has the potential to assist MFIs in increasing transparency of transactions, improving the efficiency of the KYC process, promoting economic identity of the unbanked, and reducing operational costs. The study will also explain the experience and results from a pilot application of BanQu’s blockchain platform in real MFIs that offer water and sanitation loans in Peru.

The IDB selected BanQu’s platform for this study due to its mature stage and proven implementation record in similar studies, its flexibility to be adapted for pilot requirements, and the ease of use of its interface design.

The study provides an overview of the current state and unique challenges of the water, sanitation, and hygiene sector in Latin America and the Caribbean (LAC), as well as an overview of the microfinance industry, access, and financial inclusion in LAC. Subsequently, an explanation of the basic concepts and characteristics of blockchain technology will be provided to understand the blockchain platform that was selected for the pilot application, and how this platform was implemented with real MFIs in Peru to explore the potential of blockchain in the water and sanitation microfinance sector. Lastly, the experiences and findings of a four-month pilot that provided preliminary results and motivated further analysis of the technology will be described.
Water, Sanitation, and Hygiene in Latin America and the Caribbean
Water, Sanitation, and Hygiene in Latin America and the Caribbean

Current State

Around 37 million people in LAC do not have access to improved drinking water sources, and approximately 110 million people lack access to proper sanitation services (IDB Water and Sanitation Sector Framework, 2017). The lack of access to improved drinking water and basic sanitation services generates important issues and costs to populations and governments in terms of health, productivity, and lost time. Although an important part of the population in LAC have the capacity and willingness to pay for water and sanitation services, high up-front costs of connecting to a piped water supply or of building a basic sanitation service are a disincentive to many households across the region.

Sustainable Development Goal #6 (SDG6), specifically the targets of 6.1 and 6.2, aims to achieve universal coverage of water, sanitation, and hygiene services by 2030, including quality variables. For LAC, achieving these targets will require significant effort and investment on the part of the region’s countries. A 2016 study by the World Bank Group that focused on SDG 6.1 and 6.2 found that the LAC region will need to invest USD 14-18 billion annually, estimated at 0.23% of the gross regional product (collective GDP), in order to meet targets by 2030. Strategic partnerships between the public and private sectors, new business models, and innovation in technology could be the way to bridge the gap to improve access to water and sanitation services for all.

Unique Challenges

Despite advances in the LAC region in recent years, especially in terms of access to drinking water, there are still significant challenges in the water and sanitation sector. Key challenges that need to be addressed to meet SDG 6.1 and 6.2 are related to:

- providing equitable access to water and sanitation services, in both quantity and quality, especially in peri-urban, rural, and indigenous populations
- investing and maintaining sewerage systems, including treatment
- improving the quality of water supplied in terms of potability, continuity of service, and pressure
- enhancing administrative and operational efficiency of utilities
- ensuring financial sustainability
• establishing a governance framework

• promoting intersectoral articulation, including but not limited to, territorial planning, agriculture, energy, and health

• improving disaster risk management and long-term planning adapted to the challenges of climate change and the consideration of environmental impacts

Although the LAC region has made relative progress in comparison with the global situation, lack of access to basic sanitation is one of the main sectoral challenges. Only 50% of the LAC population is connected to sewerage and only 30% of that sewage receives any treatment. In fact, over 18 million people, mainly in rural areas, continue practicing open defecation. In addition, numerous sewerage network projects observed a connection rate of only 50% to 70%, which shows that the challenge of expanding access to services also must involve consideration and deliberate activities addressing the state of readiness of wastewater inside the house.

Experience indicates that in order to solve these challenges, it is necessary to provide the right incentives and mechanisms to low-income families to finance the costs of installation and improvements of hydro-sanitary facilities inside their homes. Also, it is important to ensure the existence of policies, norms or regulations to incentivize the connection and to raise public awareness about the social and environmental benefits of connecting to the service.
Microfinance in LAC
Microfinance in LAC

An Overview of the Industry

Microfinance Institutions (MFIs) are organizations that provide small loans to borrowers who typically lack collateral, steady employment, or a verifiable credit history and therefore do not have access to traditional commercial banking. These loans, referred to as microcredits, serve as financing instruments for individuals who otherwise would not have access to formal banking. The difference between a microcredit and formal credit lies in the smaller size and duration of the financial transactions, and also refers to the socioeconomic context in which it occurs.

Usually, microcredits are offered to low-income individuals from peri-urban and/or rural areas, without a credit history and often no guarantees. This introduces two reasons that interest rates for microcredits are generally much higher than in commercial lending. The first is that without a credit history or a mechanism for ensuring repayment (collateral or guarantees), the loan is considered to have more risk for the lender. The second reason is the geography where borrowers live. Microfinance institutions use a labor-intensive approach for attracting new clients, monitoring, and disbursing loans. Loan officers are constantly going out to sell their microfinance institution’s products by visiting clients face-to-face in small villages, rural areas, and slums. This translates to higher operational costs compared to regular financial institutions, where customers go to bank branches.

To provide an example, if a microfinance institution spends US$ 50 to administer a US$ 500 loan for one year, that percentage (10%) of operating cost needs to be built into the price of the loan. On the other hand, a regular bank would spend a significantly lower percentage in operating costs for managing a loan (no visits associated with finding clients and issuing the loan), and the loan amounts are usually larger, which would result in a lower interest rate.

As a result, the rates that microfinance institutions charge to customers is usually much higher than the rates charged by regular financial institutions. In LAC and in other regions, it is very unusual to find microcredits with interest rates less than 20%. In most countries, rates range between 30-60% and can even get close to 100%.

Nonetheless, the microfinance industry seems to be growing in the LAC region. From 2001 to 2009, IDB estimated the microfinance portfolio grew from US$ 1 billion to over US$ 12 billion (Pedroza & Paola, 2010). The trend continued in the last decade and was estimated to be nearly US$ 50 billion, serving over 22 million customers, in 2019. In addition, there remains considerable opportunity for growth serving rural markets in LAC. Of the total portfolio, only 23% of microfinance clients in LAC are from rural communities, compared to 65% of rural clients being served by microfinance globally.
Access and Financial Exclusion

The LAC region has a high rate of financial exclusion. According to an IDB report (Fintech, 2018), approximately 46% of the adult population do not have a bank account. Also, small and medium-sized companies (SMEs) in the region, which account for 90% of all companies, have difficulty accessing credits, mainly due to lack of credit history or liquidity. However, this scenario of financial exclusion could change thanks to rapid technological development and quickly increasing internet penetration rates the region is currently experiencing. Latin America is one of the top regions in the world when it comes to the growth of mobile connectivity; penetration is expected to reach 73% by 2025, with some countries such as Chile, Uruguay, and Argentina already near market saturation.

The challenge ahead is to find innovative ways to promote financial inclusion of those who most need it and to improve cost efficiencies of accessing financial services through new technology and business models. Access to basic services such as safe water and sanitation should no longer be seen as a commodity, but as a societal right for any individual.

Tackling the challenges faced by the microfinance sector could accelerate the achievement of basic and improved levels of access of water and sanitation for many families around LAC and the rest of world.
What is Blockchain?
What is Blockchain?

Evolution

The connotation of the word ‘blockchain’ can have more weight than the actual meaning. Often, people hear ‘blockchain’ and think of ‘Bitcoin.’ Interestingly, at the time of this writing, a Google search of the term “blockchain” yields 238 million results, while a Google search of “Bitcoin” has more than double that, with 497 million results. In simple terms, Bitcoin is a cryptocurrency and is just the most well-known application of blockchain technology.

It can be helpful to approach the definition of blockchain by first discussing Distributed Ledger Technology (DLT) because blockchain networks are a particular type of DLTs. At a high level, DLT enables the development of decentralized networks to register information. In these networks, each of the participants, called nodes, owns a copy of that register of information that is synchronized with all the others. Blockchain networks are also immutable and have smart contracts that enable the automation of processes and the tokenization (digitalization) of assets. DLT emerged in the early 1980s (Rauchs et al., 2018) and blockchain technology was developed a decade later and has continued to grow in popularity and application.

Blocks and the Chain

Blockchain technology includes the attributes of DLT but goes a step further with additional unique characteristics. The “block” in blockchain refers to the way of clustering data. Data is stored in sets, referred to as blocks. Each block can contain several pieces of information broadcasted by different participants, called transactions.

The chain concept refers to how the blocks are connected. Each block has its own signature in the form of a code, referred to as its hash. The hash of a block is an output of an algorithm, or mathematical equation. At a very basic level, one can remember that the inputs for the algorithm include the data being stored in that block, the block number, the timestamp, and the hash of the previous block. Therefore, each block can only be added with an input that is completely dependent on the previous block, linking the blocks of data together in a chain cryptographically, therefore guaranteeing the immutability of the network.
Blockchain Uses for Microfinance Institutions in the Water and Sanitation Sector: Pilot Study

Key Attributes of Blockchain

There are some key characteristics often associated with blockchain technology. As a subset of DLT, blockchain has distributed storage. The entire blockchain is saved across multiple devices, referred to as nodes, creating redundancy and adding to the security of the technology.

Next -- and some would argue this to be the most important characteristic -- is the aspect of consensus. Without a central authority, blockchain is decentralized. Before adding a block, there must be consensus among the computers solving the algorithm (to come up with the hash as discussed above) in order to add a block to the chain. Consensus is what keeps the blockchain identical across all nodes in the distributed system.

Different mechanisms can validate consensus before adding a block. One of the most common is Proof of Work (PoW), where computers are competing to solve the algorithm first, with the winner broadcasting the solution across the network for validation. This is the mining aspect of blockchain. Miners are people or computers that commit computing power. In cryptocurrency blockchains, miners are incentivized by being rewarded with the given currency if they are the first to solve the algorithm correctly. This is what introduces the question around blockchain sustainability due to the energy consumption used in mining for cryptocurrency. There are counterarguments as well, including the prevalent use of renewable energy for cryptocurrency mining and the potential to eliminate other impacts through encouraging digital transactions instead of requiring carbon consumption of driving to a buyer, a customer, or a bank. Regardless, in non-cryptocurrency blockchains, the currency reward does not exist and much less computing power (therefore energy) is required.

Proof of Authority (PoA) is another example of the commonly used consensus algorithms and is more appropriate for the case for microfinance (non-cryptocurrency blockchain). The PoA consensus algorithm leverages the value of identities, where the block validators are those selected by an algorithm according to the percentage of stake that they hold in the blockchain network. Therefore, the more stake one has, the higher should be his or her interest in preserving the network.
Lastly, immutability is certainly a unique distinguishing aspect of blockchain technology. There are a few reasons why data cannot be corrupted within a blockchain. First, the data in each block is an input to the algorithm that determines the hash for that particular block and also indirectly impacts the hash of all subsequent blocks. Therefore, no one can change the data in a blockchain without it being easy to identify because the outputs to the algorithms would no longer be correct. Second, due to distributed storage, if the data was changed in one node, that original data remains secure across all the other nodes of the network, and the corrupted node is not allowed to synchronize with the others.

Configurations Around Access and Privacy

Privacy is another key topic in blockchain. On one end of the spectrum, there are blockchains such as Bitcoin, which is a public, open, and permissionless blockchain. Anyone, potentially anonymously, has access to read and write to that blockchain whether they are a participant or have any stake or own currency (as reviewed above, no one ever has edit capabilities in blockchain technology). Blockchains can also be permissioned, the types of which include private-permissioned and public-permissioned.

A private-permissioned blockchain is permissioned, which means that only selected participants can join and only known nodes can participate in the network. Private-permissioned blockchain are more appropriate for users who require an additional level of security, identity, and role definition within the blockchain network.

Figure 2. Examples of existing blockchain solutions on a spectrum of privacy and permissions
**Smart Contracts**

A smart contract is a piece of code that is executed simultaneously across all nodes of a blockchain. This functionality prevents deliberate manipulation and data integrity issues due to multiple submissions in a short amount of time; smart contracts do not allow multiple distinct outcomes from a single action. Blockchain technology can digitally facilitate and execute immutable transactions between participants without requiring action or approval of a middleman or trusted authority with smart contracts. It is important to note that not every action on blockchain has to be deployed by a smart contract, but all the transactions are, one way or another, within a smart contract.
What is BanQu’s blockchain platform?
What is BanQu’s blockchain platform?

BanQu, Inc. is an organization focused on bringing transparency, traceability, and accountability to global supply chains and value chains. The BanQu blockchain platform gives organizations real-time access to the assets in supply chains. At the same time, the platform provides the participants of those supply chains the power to own, access, monetize, and permission their individual data. This is often the first time that point of origin contributors in global supply chains have equal and secure copies of their transaction history, giving them verified economic identities.

Do You See Blockchain Here?™

Rather than seeing blockchain only in state-of-the-art facilities and industries, the BanQu platform brings cutting-edge technology and associated benefits to the businesses, organizations, and governments that interact with the world’s poorest on a daily basis. A natural use case is connecting global brands that are sourcing raw materials in emerging markets to smallholder farmers. However, the power of BanQu’s blockchain platform extends into any value chain where there is a desire for transparency, immutability, and data democracy for all parties of a transaction based upon three foundational data tenets: people, organizations, and assets (digital or physical).

Some live examples beyond asset traceability of crops from smallholder farmers include:

• To improve youth employment outcomes, BanQu immutably verifies course completion, test scores, and employment history for 675 students in Costa Rica.

• To eliminate child labor in tobacco farming, BanQu simplifies data capture and digitizes a child labor monitoring system to bring transparency across various stakeholders, including local schools and communities; following the pilot in Malawi, the BanQu solution is being deployed in Brazil, Tanzania, and Zambia and now supports over 40,000 households and over 80,000 dependents.

• To ensure safety and security, BanQu provides 300 brand ambassadors in South Africa a direct connection to the brand, around local agencies or middlemen, for grievance communication to ensure safety and security.

• To create circular economies, BanQu creates economic identities for 1,000 labor workers capturing used packaging as well as tracking waste kept from landfills in Zambia.
Each of these interactions is captured on blockchain, creating a secure, immutable, and distributed ledger of transactional and personal records. BanQu’s blockchain platform allows partners to evolve from traditional databases where individuals have no power to validate their data. With BanQu, individuals not only validate data, but are empowered with ownership of their data.

A Proven Track Record

BanQu has a maturing platform and has been in commercial production since early 2017. Deployments span 15 countries across the globe, building economic identities for over 200,000 (and growing) beneficiaries. An economic identity is the marriage of identity and commerce, resulting in a global, vetted, and manageable asset. This identity consists of the digital or electronic credentials that define a person’s history of economic interactions and participation in the world economy. All of this data is secured at the participant level; security and privacy rights of individuals are considered non-negotiables in BanQu implementations.

In addition to creating economic identities for smallholder farmers and workers, BanQu has integrated with local telecom companies so individuals can be paid directly to their mobile money account. This decreases physical risk, especially for women, that they would otherwise have in carrying their profits home along routes known to have many cash-carrying individuals.

Following BanQu implementations, local banks have taken new interest in smallholder farmers and workers who are building validated economic histories because it decreases the risk for them as potential lenders. An individual’s history on BanQu becomes credible data for underwriting, enabling them to break from the cycle of being unbanked due to only having paper or unvalidated receipts and information.
Blockchain in Microfinance

A Natural Fit

As microfinance is a tool that provides financial services to the unbanked or underbanked, the individuals being served are the same people who benefit directly by gaining access and ownership to their economic history. This is another example where blockchain is differentiated and has huge advantages over traditional databases, where authority, ownership, and access are one-sided. In traditional models, individuals may be granted access, but that access can also be turned off based on the decisions of those in power. With blockchain, individuals who are getting a loan for the first time can own the verified approval and repayment information beyond the term of the loan. This information can be used for subsequent loans or other financial products at the same or different institutions.

Among the challenges that MFIs face, a key hurdle is the high operational cost relative to the small loan amounts. This contributes to high interest rates for low-income borrowers. A variety of drivers cause this dilemma; two factors are those that blockchain can easily address: (1) the difficult and expensive Know Your Customer (KYC) security measures, and (2) the lack of technology to digitize data for greater efficiency in processing and monitoring customer loans.

KYC is the process and requirements for businesses to verify the identity of customers, to assess suitability, and to ensure the actions of the business are not unknowingly supporting or participating in illegal activities. Again, given that microfinance is specifically for those without existing digital economic identities, the KYC aspect of giving loans to the unbanked becomes even more difficult and expensive. Loan assessors spend time in communities validating the identities through traditional national identity cards and visiting the homes of borrowers, neighbors, and local business to verify identification, background information, and sources of income.

The other key challenge driving operational costs is the lack of technology causing additional manual processes outside of the KYC activities, especially in emerging markets. While blockchain has value over and above traditional database architecture solutions, simply moving to electronic processes opens the door to decrease administrative costs through optimization of efforts and reducing manual workload around transcribing data from paperwork. Additionally, moving to electronic processes decreases risks associated with borrower privacy from carrying and storing sensitive paperwork. Blockchain technology provides both the borrower and the lender real-time access to data as it is being created, further streamlining communication between parties.

A final intricacy in the microfinance process that blockchain technology could improve, is that microfinance institutions aim to capture proof of how the loan was used. This is sometimes captured electronically with a photo of the loan assessor and the installed asset (e.g., a toilet or water tank) and requires the loan assessor to revisit the borrower’s home to verify the progress of the loan’s use. Using geotagging functionality, the borrower could instead upload a picture of the finished project to the blockchain platform, validating the location and appending the photo to the loan record.
The Power of an Ecosystem

Without a central authority, blockchain technology lends itself to encourage an ecosystem approach, which has the potential to decrease operational costs and improve lending decisions in microfinance.

In today’s world, loan assessors get creative in assessing the risk of a loan. They visit the home of the prospective borrower and explore different ways to verify the borrower’s income. To validate estimated expenditures (another way to prove income), loan assessors visit the local grocer or pharmacist to ask questions regarding existing business and any informal loan repayments of the potential borrower. These steps require a considerable amount of time, which translate to high operational costs for the MFIs, especially when considered relative to the small amount of the loan.

Blockchain technology could be used to create a more holistic view of the financial position of a potential borrower, which could result in better lending decisions and fewer loan defaults for the MFIs. Blockchain answers the challenge of how to capture and authenticate data from disparate systems and sources that would provide a comprehensive view of the financial position of the borrower. This could be done in the blockchain platform by adding service providers, such as phone service, utilities, or any credible third party, to enable the validation of information across these multiple parties for a shared KYC while promoting the creation of a more complete economic identity for the individual that could then be used to acquire additional services, financial and beyond.

The blockchain platform chosen for this study, BanQu, allows anyone who has access to a mobile phone to join the platform, owing to its compatibility with all types of mobile phones, and availability in all languages. Once users create an account, they can start making transactions, which are recorded on blockchain, a distributed digital ledger of transactions that is both secure and immutable. Each party in the transaction receives an equal record, which serves to democratize access and ownership of personal data. As these transactions accumulate, they begin to constitute an individual’s economic identity. Transactions need not only be buying and selling, but they can also include property records, educational and employment certifications, and more.

As an example, for this pilot study potential borrowers could add their electric utility or other service provider to the blockchain network, which can then add and verify the borrower’s records of making payments and start recording new transactions that will help MFIs assess the risk of the borrower and build the individual’s economic identity. It is important to remember that blockchain also ensures data privacy for the borrower, as the individual gets to decide what to share and who can validate accuracy.

Finally, it is key for organizations that are supporting microfinance loans for a specific outcome (such as access to water and improved sanitation) to confirm the impact of their contributions. Integrating with service providers, as well as the geotagged photo of the completed project, provides validated proof that the loan was used for the intended purpose.
Pilot in Peru
Pilot in Peru

Objective

The purpose of the pilot in Peru was to prove the viability of implementing blockchain technology into water and sanitation microfinance to improve the efficiency of the existing microfinance model and promote financial inclusion of unbanked individuals. Piloting would also provide the opportunity to learn more through on-the-ground realities at the borrower level, as well as within local MFIs.

Following the in-country survey, the high-level objectives of the pilot were defined as follows:

- Three MFIs that currently offer water and sanitation microcredits in the Lima area would participate in the pilot.
- The pilot would run for four months.
- Each MFI would identify five to 10 loan assessors and at least one loan approver for participation in the pilot.
- Loan assessors and approvers of each of the selected MFIs would be trained in the use of the blockchain platform.
- New borrowers would be registered on the blockchain platform and receive loan notifications directly to their phones via SMS messages.
- Loan forms and approvals would be completed directly on the blockchain platform.
- Proof-of-use (showing how loan proceeds were spent) would be captured, all at the borrower level, for any borrowers with complete installations during the pilot.
- Repayment details would be updated by loan assessors, as the pilot would not include all branch locations for MFIs or run the duration of most loans.

Key Partners and Players

The key partners and players that allowed the successful implementation of the pilot are described below:

- **Inter-American Development Bank (IDB)**: provided the methodology, leadership, and financial resources to implement the pilot in Peru.
• **Water.org**: provided key knowledge about water and sanitation microfinance in Peru, and access to partner MFIs in the country that offered water and sanitation products.

• **BanQu**: provided the blockchain platform, training to MFIs, and overall technical support throughout the implementation of the pilot.

• **MFIs**: provided access to current data and processes about water and sanitation microfinance in the pilot area, support of MFI’s branch managers and loan assessor during the implementation of the blockchain platform, and access to real borrowers.

• **Borrowers**: water and sanitation microfinance clients (actual borrowers) that participated during the process of testing the blockchain platforms.

• **Suppliers**: local water and sanitation infrastructure suppliers that provided insights and information for a future phase of the pilot that can record borrowers’ transactions related to the supplies acquired to build water and sanitation infrastructure.

**Area of the Pilot**

To pilot the blockchain platform in water and sanitation microfinance, the first step was to identify a location where MFIs existed offering water and sanitation products and would be open to pilot a system with actual borrowers.

Water.org provided landscape information and direct contacts to MFIs providing microloans for water and sanitation in Peru. The peri-urban area of Lima was selected based on strong existing relationships with MFIs offering water and sanitation loan products and that had support available to deploy the blockchain platform across multiple MFIs.

**Current Loan Cycle of selected Microfinance Institutions**

In Peru, microfinance-based loans are commonly made for indoor toilets, water and sewer connections, improved sanitary installations, and tanks for water collection and storage. The loan cycle begins with a promotion or the weekly trips of loan assessors from MFIs going into the field, visiting poor neighborhoods and communities. Weekends are optimal, as prospective borrowers are at home. Loan assessors carry bullhorns to communicate both the health benefits of clean water and sanitation and about the products being offered and the terms and conditions of the microloans.

When the loan assessor finds a prospective borrower, the process of data collection begins in order to assess the loan risk and meet the KYC requirements. This includes writing down estimated income and expenditures on the loan form, along with marital status, number of dependents, and other risk factor data. Depending on the information available, loan assessors can check to see if there is an existing business at a given address or visit local grocers or pharmacists to corroborate the data. This data and activity are all captured on paper and the loan assessors
also sometimes take photos at the given location of where a water tank or toilet is to be installed for legitimacy. There is some variety across the timing of these steps, the number of visits required to a borrower’s home, and the approach in finding interested borrowers. After collecting as much information that can be validated, the loan applications are brought to a central location for review and approval. The paperwork is stored in paper files at the central location of the MFI.

The decision about the approval or denial of the loan is communicated via phone within a few days. If the loan is approved, the borrower would have to travel to the MFI’s branch office to sign the corresponding loan documents, and to collect the loan amount (often disbursed as cash). If the loan is denied, the loan officer would explore the options to collect missing information about the borrowers that led to the denial of the loan, and then start the approval process once again. Throughout the duration of the loan, the borrower has the option to make payments at any branch of the MFI or at other payment facilities approved by the MFI, while meeting the stipulated payment periods stated in the loan contract.

The next step in the loan cycle is for the borrower to buy the supplies and build or contract services to install the water or sewage infrastructure for which the loan was approved. During this step, the MFIs do not have the instruments or resources to verify that the borrower has procured the correct supplies for the purpose of the loan. The only instrument that the MFIs use to verify the proof-of-use of the loan is to perform random visits to some of the borrowers’ homes to corroborate if the infrastructure was built and installed properly. These random visits are only performed to a small portion of the borrowers since this is an additional operational cost for the MFIs.

The loan cycle is closed once the borrower has completed the last payment stipulated in the loan contract. For most cases, the MFIs do not require proof-of-use of the loan to the borrower in order to close the loan contract.

Figure 3. Current state of the loan process and participants
The current loan process is very manual and requires significant paper, pen, and human documentation for the KYC process. This introduces opportunities for error in translation from source to party within the MFIs. Digitizing this process would be hugely different with efficiency and real-time access for all parties. Information would be verified directly and/or continually, by the source of the data.

While the scope and duration of the pilot were not long enough to include the complete ecosystem approach, the process could be strengthened by including additional stakeholders, such as the supplier/provider of the water tank, toilet, or other water expenditure, which can support the verification of the use of the loan, and record and validate transactions in the blockchain network for the borrower’s financial records to give that individual greater economic identity.

Further, by expanding access to the blockchain network to local water and sanitation utilities, the information about water and sanitation infrastructure loans at the borrower level could provide important data for utilities that are considering expanding water supply and sewage systems to communities that are not connected to the main system or are not receiving full services. Utilities could use water and sanitation loan data to know the number of users and type of infrastructure that is currently installed in a specific community.

**Operational Guidelines**

As described in the previous section, one of the first steps for implementing the pilot was to conduct an on-the-ground survey to learn more about current processes and challenges faced by MFIs. Six different MFIs were pre-selected and gathered in Lima to share their processes and procedures, including a field visit to observe live examples of meeting new prospective borrowers.

Out of the six MFIs, three were selected to participate in the pilot according to their interest in the blockchain platform proposal, their capacity to implement the pilot in a short timeframe, and the quick access to real borrowers who are in the market for water and sanitation loans.

The next step was to develop a graphical user interface (GUI) in the blockchain BanQu’s platform that would meet the loan data fields and requirements that each MFI demands during the loan cycle, from pre-qualification and approval, to monitoring and closing.

The developed GUI in the blockchain platform has four key functions, as described below:

1. **Borrower Registration:** When an individual wants to apply for a loan, MFI personnel register them on the blockchain platform. All potential borrowers should be registered, even if they do not ultimately receive a loan.
2. **Loan Application**: MFI personnel navigate to the potential borrower’s profile hosted in the BanQu’s blockchain platform and fills in their portion of the Loan Life Cycle Form.

Then, MFI personnel responsible for approving the loan are automatically notified that a new application has been submitted and complete their portion of the Loan Life Cycle Form.
The potential borrower can log into their BanQu account at any time to check the status of their application. The borrower will receive an SMS and/or email every time an update is made to their loan form.

**Figure 6. Reviewer and Approver Section GUI**

**Figure 7. Loan process notification to the borrower**

3. **Loan Issuance and Repayment Status:** A “buy transaction” is performed to signify disbursement of funds if the loan is approved. This sends the borrower a Peruvian Soles asset for the amount of the loan. This asset can be used to prove the funds were used for the agreed upon use if purchasing water and/or sanitation equipment from an entity using the BanQu platform.
The borrower receives a text with a nine-digit claim code that they give to the cashier to enter in BanQu platform. This results in the borrower receiving another text, this time with a six-digit confirmation code. The borrower provides the code to the cashier and the cashier gives the borrower their cash. The borrower receives one more text letting them know the transaction is complete and to respond to the message if anything is wrong. This process ensures the borrowers are actually receiving their full loan amounts.

**Figure 8. Buy transaction GUI.**

**Figure 9. Loan confirmation automated text**

Borrower 6,
You sold 1 EA of Sanitation Loan (500 SOL/EA)

Paid: 500 SOL of Peruvian Soles (claim code: E89-1E2-276)

Msg to +18336000030 if incorrect
At the time of disbursement, the MFI personnel also fill in the relevant loan details on the borrower’s Loan Life Cycle Form. The Loan Life Cycle Form will also capture:

- Loan status
- Details about loan repayments (can be captured in the comments field)
- Proof of proceeds (such as a picture of the equipment purchased)

4. **Displaying Proof of Proceeds:** The borrower can show proof of proceeds spent in one of two ways. If the borrowers purchased from a supplier utilizing the BanQu platform, they can share their transaction history, which will show the water and/or sanitation asset purchased. If they purchased from an entity not on the BanQu platform, a photo of the receipt or of the equipment in their home can be used as proof.

In order to request shared transaction history, the MFI will need to request that the borrower’s transaction history be shown on their profiles. To do this, the MFI will find the borrower in the BanQu platform and will use the action menu on the connection tile to select “Request More Info”. From there, MFI personnel will select “Transactions” and if desired, a date range in which that information can be shared.

![Figure 10. Data transaction sharing request GUI.](image)

The request will send both an SMS and email notification to the borrower requesting that the information be shared.
When the borrower approves the request, their transaction history will be displayed on their profile.

![Image of transaction details]

**Figure 12. Borrower’s transaction history GUI.**

If the borrower acquired water and/or sanitation equipment outside of the BanQu platform, a photo can be used as proof and can be uploaded to the Loan Life Cycle Form by the borrower or MFI personnel.
Once the GUI was completed and tested, the selected MFIs received a complete training on the use of the blockchain platform. The training sessions covered the following components on how to capture new loans using the blockchain platform:

- Register borrowers
- Upload pre-approval documents (e.g., proof of income, proof of home ownership or lease, etc.)
- Notify borrower about loan approval, denial, or require additional information
- Upon approval, initiate loan, including loan use categorization
- Upon loan completion, ensure use of loan is documented (agent or borrower)
- Capture all loan repayments and proof-of-use

Participants in the training sessions included field agents, approval committee personnel, and cashiers. The trainees were requested to train other MFI personnel as necessary for additional support.

Once the training on the blockchain platform was completed, the three MFIs were ready to go live with real borrowers at the selected locations of the pilot. The MFIs used the blockchain platform across new loan cycles during a period of four months.
Pilot Findings

In Peru, there is a growing and pressing demand of customers for financial products to support water and improved access to sanitation. With 58% of the Peruvian population unbanked, 9% without access to clean water, and 25% without access to improved sanitation, expanding microfinance to reach more people requires urgent attention.

There were three main challenges during the pilot that were consistent among the selected MFIs regarding water and sanitation loans. The first was the low efficiency of loan process from start to finish, which relies heavily on manual paperwork and processes, introducing possibilities for errors, and slower communication and throughput. The second challenge involves the barriers and supplementary effort associated with water and sanitation microfinance that the MFIs have to face. MFIs are expected to offer water and sanitation loans in conjunction with a broader range of services when compared to other loan products. They have to promote demand creation for water and sanitation products, including educating borrowers about the benefits, assisting borrowers with technical advice related to adequate infrastructure and products, and ensuring the proper end-use of the loan. The third common challenge was the high operational cost and low outreach, which is exacerbated by the terrain in the area that made it difficult and expensive for outreach and follow up. Reaching out to unbanked and low-income individuals is usually expensive when compared to commercial banks because of the higher operational costs of small loan sizes. These higher operational costs translate into higher interest rates for the borrower.

The selected MFIs also described much lower outreach in rural communities than in peri-urban areas of Peru, which underscores the need for the development of efficient and cost-effective ways to deliver microfinance services to rural communities in the country.

In addition, organizations such as the IDB and Water.org which provide institutional strengthening and funding to MFIs, have challenges related to real-time visibility into the impact of their contributions and support to in-country MFIs. For example, a factor that mainly affects donors (and was less important to MFIs because their focus was on repayment) is that proof-of-use of the loans was found to be very difficult to capture and share across organizations in the current state of microfinance operations.

The blockchain platform implementation immediately addressed the first challenge by digitizing the data capture and loan approval process and by creating a real-time communication channel for the borrower to submit information and to receive loan status changes, such as approvals. By replacing the manual processes and paperwork and helping to overcome the difficulties the terrain creates in reaching more customers and efficiently monitoring loans, the blockchain platform showed MFIs the potential to improve and expand services while lowering operational costs. Digitizing the process also permitted transparency among the borrower, the MFIs, Water.org, and IDB due to the ease of sharing and validating information among key stakeholders, including real-time progress and proof-of-use of loans.
In addition, the blockchain platform showed MFIs how the efficiency of the KYC process could be improved to identify, screen, and verify customers while promoting the development of the individual’s economic identity to support financial inclusion. The platform streamlined the loan cycle process from start to finish, making it simpler and faster for loan officers to capture new loans, review applications, communicate to borrowers, and monitor transactions and proof-of-use of the loan. Although the improvements to the current loan process show a clear potential to decrease operational costs of MFIs, the pilot did not have access to a breakdown of the current operational costs of each MFI. Having that information would have allowed us to perform a cost-benefit analysis of the proposed loan processes’ improvements using the blockchain platform.

Like any process or system change, the pilot experienced some adoption challenges. Capturing data on paper and transposing it into Excel or other systems for data management proved to be quite ingrained, so moving to real-time access in a new, shared, immutable, and mobile-friendly platform was a dramatic paradigm shift for some users. Unsurprisingly, change management and stakeholder engagement was critical to the new program. Leveraging existing relationships, Water.org played an important role in supporting these aspects. Both the change management and stakeholder engagement aspects were made more challenging by the short duration of the pilot.
Conclusions

The improvements seen in the existing microfinance ecosystem during the implementation of the blockchain platform can be sorted into two main groups: improved institutional performance, and data ownership for the individual.

First, the speed of a blockchain-based borrower registration and loan application system solves the gridlock that is present when critical information is captured on paper. Paper cannot be presented to multiple individuals in an organization at the same time in a secure way. Today, loan approvals sometimes take place by scheduling a meeting with all required individuals gathering in the same physical location and projecting loan applicant information onto a screen for all to see. After the meeting, the data is physically filed away and not easily accessible again in the future. When personnel with different roles within an organization need access to important documentation, it needs to be both accessible and secure. With the blockchain platform solution in place, information on both the registration of new borrowers and their loan applications was shared immediately with everyone holding appropriate permissions within that MFI. For example, Loan Assessor A could see that Borrower 1 had been registered by Loan Assessor B, so there is no need for wasted effort on recruiting that same borrower. Loan Approver C could see the loan application details flow into the system in real-time, even if that Loan Approver was hours away in a different branch location or even halfway around the world. That is the power of instant, immutable on-chain data capture.

It is important to realize that these improvements do not exist in a vacuum and are therefore not mutually exclusive. Therefore, combining the security of the blockchain, the speed of data capture, and the ability to execute these technological efficiencies on any internet-enabled device can lead to improvements in institutional performance. This institutional performance has spillover effects that could certainly be the main thesis of a future study. One important spillover effect of introducing the blockchain platform to MFIs in Lima metropolitan region was the confidence gained by the personnel in the field during borrower recruitment. During implementation, direct feedback from a loan assessor at one MFI noted that the increased efficiency of recording information digitally increased professionalism and, therefore, the credibility of the loan assessors and the products offered.

The most important benefit of deploying a blockchain-based solution for microfinance is that the ownership of the data is in the hands of the borrower, only to be shared with consent. This is a key advantage that can be realized by a blockchain platform to ensure data privacy and ownership for individuals taking advantage of the decentralized nature of its ledger system. The ledger system is not isolated to one primary server or central ledger, such as in the case of traditional banking systems. Instead, the ledger is shared among a variety of computers, which creates a system that is decentralized. Data ownership can be put back into the hands of the individuals by giving them a choice to select, for each piece of data that they create, whether they want to allow third-parties to have their information. Individuals, borrowers in this case, are given the tools to own, access, and permission their immutable transaction history.
Currently, a key driver to the high interest rates is the expensive and manual KYC process in verifying the identity and risk associated with an individual. With verified profile data in the hands of the borrower, the borrower becomes a more attractive client for other finance institutions (and businesses), opening doors to more competitive rates for subsequent loans. With the completion of a loan (and the associated repayment data), the borrower is further ahead in obtaining additional services and true financial inclusion.

This pilot was conducted over a less-than-ideal timeframe; a longer pilot would have allowed the researchers to analyze a complete loan cycle. Future pilots are encouraged to test if these improvements to business efficiency and borrower empowerment will lead to a reduction in operational costs to MFIs and could potentially translate in lower interest rates for customers, a key challenge for the microfinance industry in serving low-income and marginalized populations.
Sources


