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New media strategies for inclusive financial opportunity

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1. Introduction

The financial systems of the world are highly interconnected. New forms of digital media allow for people across a city and across the world to communicate and coordinate their actions instantly. Buyers in one country can connect directly with merchants in another country in e-commerce markets mediated by the internet and web browsers. In the contemporary context of digital communications and globalized trade, it is meaningful to speak of a single global "financial system". This financial system is also highly exclusive. It has been built to serve the interests of its customers, who are people with access to finance. While it is highly interconnected within the media systems which connect markets, corporations, supply chains, banking channels and more, the financial system excludes anyone without access.

This financial system can never include everyone because it is composed of faceless institutions. In order to provide financial services such as loans, financial institutions need to be able to trust their customer. The institutions need to trust in the customer's identity and trust in their willingness and ability to repay loans. Financial institutions can only attempt to simulate this kind of trust which is readily available in ordinary personal relationships. To simulate this trust, they rely on documents and records that they know are trustworthy, because the documents are produced by other trustworthy institutions. This is a vicious cycle in which for one faceless institution to trust you, another faceless institution must trust you enough to vouch for you by providing a trustworthy record of your personal information or identity. Each document is, by design, difficult to obtain, and excludes the most vulnerable populations from access. Instead of perpetually trying to expand formal financial inclusion and perpetually running into obstacles, the greatest opportunity for financial inclusion lies at the source of trust, namely grassroots

community associations and in particular communal savings groups, where people who are part of each other's lives gather in person to save and loan together as a group. Anyone could potentially join or form an informal group like this, with or without institutional access or access to a phone. New media has just opened up the opportunity to change the medium of record-keeping in these groups from a paper ledger to a digital ledger, as long as at least a few members of the group, which typically range from 10 to 100 people, have cell phones. This digital record is as trustworthy as any institutional document. It can be used to allow these savings groups to communicate and coordinate with one another, building an alternative financial system for the self-strengthening of their communities.

1.1. The tragic state of economic exclusion

Financial exclusion takes on the distinct appearance of a class hierarchy, in which financial privileges are available only for those with the right background, the right identity, and the right amount of wealth to begin with. The rich get richer while the poorer one is, the fewer opportunities are available to you to grow your wealth for the sake of your life, the lives of your children, and the wellbeing of your community. This state of the financial system ensures that the rich individuals, rich families, rich ethnicities and rich countries get richer as the decades of the capitalist epoch proceed. With that wealth, rich people continue to strengthen and perpetuate the set the rules, of the financial system and of social institutions more generally, that made them rich in the first place. In this way, historical injustices which cripple the wealth of a community, nation, or group of nations are still very much present today. The victors in such conflicts multiply their wealth over the span of lifetimes and generations, while the others are left to

remain in subservient economic roles, forbidden from accessing the systems of finance which continue to enrich those in possession of ill-gotten wealth.

Bank accounts are extremely valuable to have. A clear benefit comes from having a safe place to store money instead of throughout your house. A bank account makes day-to-day life less complicated and allows people to build up their assets. Crucially, a bank account connects people to the formal financial system. Access to a bank account could help the holder access digital financial services, such as mobile payments or fintech apps. Someone with an account is more likely to start or expand a business (Forbes, 2018).

According to World Bank data, almost 2 billion adults do not have a bank account. China has the largest number of unbanked people at 224 million (16% of its population), followed by India at 191 million (14% of its population), then Pakistan at 99 million (50% of its population), while the United States has 18 million (6% of its population) (McCarthy, 2018). 6% of the population of a country is a sizable demographic, while 50% of a country's population being unbanked is a significant barrier for that country's economic growth.

Banks may be physically inaccessible to people, who may not own the phone, computer, or internet service necessary for online banking. Banks may also exclude people who don't have the right identification or who don't have enough money to make the account profitable for the bank.

Data from the International Labor Organization shows that more than 60% of employed people work in informal economies (ILO, 2018). One of the report authors describes how "informality means a lack of social protection, rights at work and decent working conditions, and for enterprises it means low productivity and lack of access to finance."

Informal employment is most prevalent in Africa, followed by Asia and the Pacific, then the Americas, then Europe (ILO 2018). An economist named De Soto has made the case that an informal economy exists where states or other institutions are weak, locations which lack the "hidden architecture that organizes the market economy in every Western nation" (De Soto, 731). The challenges that people face in the context of an informal economy are due to historical and ongoing processes that weaken or hinder the function of economic institutions and infrastructure. Post-colonial societies grappling with neo-colonial forms of domination fit this description, and this question of cause and effect will be analyzed in detail later in this paper.

Access to investment is one of the major benefits that comes with recognition by the financial system. Small-scale business entrepreneurs lack the expected rates of return and credit score needed to acquire loans or investment, at least at a typical and non-usurious rate. The aspirations held by those excluded from the financial system of contributing to their local economy, growing their wealth, and addressing needs held by their community through business The exclusion of wide swaths of people from financial opportunity is a tragedy in economic terms as much as a tragedy of cruel injustice. Countless brilliant and savvy people are confined to positions of menial labor by their exclusion from the financial system. Their talents are not matched with their role in the economy because they have been excluded from certain opportunities. At the same time, the pool of those with the talent and intuition for business leadership combined with the financial opportunity to take on that leadership is far smaller than it could be. The productive power of society in general is greatly suppressed by the inability or failure of established financial institutions to extend their services to all.

1.2. The world of blockchain – Solutions

Current developments in financial technology are quickly changing this situation. One of the most notable innovations made within the last decade has been the invention of blockchains. A blockchain is an immutable record of information – no hacker nor administrator can edit it once it is recorded. The database is stored and updated on a network of computers that are rewarded for their work by other stakeholders in the network. Blockchain was among the first developments in field of distributed ledger technology, or DLT. Blockchain and other DLT has enabled the creation of digital currencies known cryptocurrencies, like Bitcoin.

The innovation is important not only because of its immutability, but also because the data doesn't need to be owned or controlled by a single entity. The data can be legally owned and exclusively accessed by the network of stakeholders. A wide variety of such networks have been created, all with different rules and dynamics for how the various stakeholders interact and access data. The key concept to understand is that the rules are built into the code of these digital networks. Some of these networks operate and even change their rules according to decentralized democratic control by stakeholders. In some cases, the original developers could even be fully opposed to what the network is democratically choosing to do, but the code will respond to democratic input alone and not to anyone's privileged input. With these kinds of networks, there is the potential to have no central institution in which anybody needs to place their trust. Instead, control of the network can be decentralized.

Peer-to-peer networks have enabled ordinary people to invest in the businesses they believe in. Kickstarter is a famous website that allows people to fund a new business and has gained immense popularity.

Traditional informal systems of property rights can be tracked down and recorded onto distributed ledgers using social media, artificial intelligence, and distributed databases.

Cryptocurrencies and sovereign identity platforms allow any person with a smartphone to access credit and transfer money to or from their family across the world.

A new wave of financial technology applications is allowing ordinary people to invest their savings in a way that was once reserved only for educated professionals.

Each of these developments are fundamentally various forms of mediation, are facilitated through new media specifically, and each one faces questions of user experience, ownership and governance of the platforms, and the construction of subjectivity inherent to their use.

In expanding beyond the financial media of earlier times, these forms of media have needed to address barriers of language and knowledge while competing for attention among a saturation of similar applications and platforms.

1.3. The world of real life – Barriers

High-tech solutions to the problems of financial exclusion can sound promising, but the most fundamental problem is lack of access to these solutions. About 60% of people had a cell phone in 2016 (eMarketer 2017), with close to half of them having smart phones (Statistica 2019). The cost of a phone and service is a major barrier to increased global adoption of phones. Other factors that could prevent someone from buying a phone can be illiteracy or a language barrier. A lack of telecommunication infrastructure can make a phone useless. These factors concentrate among people with lower education, lower income, and weaker state structures. Financial applications that are designed for smartphones only have the potential to reach a small

majority of people. Some applications have been developed for use via SMS, yet these still leave over a third of people unable to use the application.

In addition to these fundamental limitations, digital efforts at financial inclusion do not always have beneficial effects for people. It is complicated to evaluate the real effect that they have on people across society, especially in the long term. These efforts are largely driven by governments seeking to prove their effectiveness and by private sector companies seeking exposure and investment. Neither variety of institution has incentives to fully investigate the ramifications of their efforts. Neither do investors and media outlets seem to expect rigorous analysis of these effects. Most people have become used to the assumption that if a business transaction has taken place, then whatever took place is between the people involved in the transaction, which must have been mutually beneficial. This justification is based on a simple cost-benefit analysis. If the economic activity generated by the socially-conscious business is greater than the economic costs, then the project has succeeded. By simply existing and making a profit, firms that claim to be solving a social problem need no other proof of their work. The cost-benefit model is used to calculate the net impact of anything that generates economic value. The model is fundamentally flawed.

1.4. Bringing nuance to the cost-benefit analysis of inclusion efforts

This section of my paper will attempt to undermine cost-benefit analysis as a tool of justification. My analysis will produce an improved model, which I will use to evaluate financial media systems in the rest of my paper. The cost-benefit model measures only monetary accumulation or lack thereof. Instead, an understanding of net impact should be measured by all its effects – whether those are social effects, environmental effects, personal effects, or any other

effect which cannot be measured in terms of economic value. It is very common for an economic relationship to generate wealth yet have a disastrous impact on the lives of some people involved. A flawed perspective would value these relationships positively, while an ethical perspective, one which incorporated more information beyond the economics, would understand the more complex reality of these relationships.

An analysis of costs and benefits must in all cases consider extra-market effects. This consideration would benefit from a structured way to look for such effects. Social theorist Nancy Fraser describe a number of systems or parts of society which can be affected by markets and in turn affect them, yet which are not themselves controlled by markets. The state, domestic labor, and the natural environment are all potential sites for additional costs and benefits of an economic relationship can be found. These systems provide the materials, the energy, the sink for pollution, the infrastructure, the subsidies, the legal frameworks, the money system, the social structures, and the common knowledge and public information necessary for markets to exist in the first place.

A non-market cost or benefit should not be understood as “fluke” or “empirical contingency” (Fraser, 59), which would place the burden on proving that such costs and benefits exist on a case-by-case basis. Instead, the very existence of markets depends on a foundation of “non-marketized social relations.” If markets are defined by things of market value traded within economic relationships, then the very existence of market valuations has non-market effects.

Social, political, environmental, familial, and other power dynamics interact with one another to create compound effects. A nuanced cost-benefit analysis will account for the effects that arise from the intersection of different dynamics. The initiation of an economic relationship,

while immediately beneficial for both parties, can cause disruptions of other social dynamics, generating additional costs or benefits.

A genuine analysis of costs and benefits must also observe power dynamics that occur within markets. The basic theoretical move here is to emphasize that market transactions occur between human beings, and not abstract market actors. An abstract analysis, for instance, concludes that the following situations generate the same value: an employer pays an employee $10 for their labor and takes $10 in profit, versus the employee earning $2 and the employer taking $18. If these people were abstract, this analysis could be justified. But if the economic relationship continues and one of the two situations repeats for a long time, the two participants are affected in very different ways by the two situations. Since multiple laborers are working for a single employer, the employer can take only a small profit from the product of each laborer's labor and still gain more wealth than any laborer. An economic analysis of market transactions abstracts the participants and considers the value of each transaction in isolation or abstract aggregation. An analysis that considers all costs would need to include the cost of social power dynamics which suppress the wealth of many while greatly that of a few.

The results of this growing imbalance of power are numerous. First, in most situations the owner of capital, through their concentrated wealth, gains undue influence over political decisions. Votes are not directly bought or sold like a commodity, but they can be influenced by expensive campaigns, lobbyists, and corruption. Political power is influenced by economic relationships in addition to other kinds of relationships, such as political relationships and tribal relationships. We can conclude that economic relationships can have effects on the power

dynamics that exist outside of the market. Since the effects are outside of the market system, they cannot be measured by ordinary, monetary measurements of value.

Second, since investment can only be made with accumulated value, the owner of capital controls all investment decisions. The result is that the owners of capital routinely ignore the non-monetized costs of their investments.

Third, the imbalance of power pushes the laborer to choose between accepting terms of employment or suffering the consequences of poverty, or even at times dying – laborers get pushed to the latter choice even in contemporary supply chains. Amazon makes some of its products in factories which have installed nets around the building to prevent laborers from jumping from the roof.

Essentially, markets give rise to economic classes arranged in a hierarchy of power. I will propose a framework for describing class dynamics in order to make this discussion more concrete.

1.5. How to measure success

Given our framework for understanding the consequences that financial media systems may have, we can define what makes one successful.

From the class analysis, we see that the unequal access to privileges allows the creation of unequal wealth, and by extension power, through an ordinary market distribution of surplus. We find that coordination of market actors can serve to capture market surplus just as market actors excluding competitors from the market, creating an oligopoly or oligopsony, also captures surplus.

Each of the participants in an economic relationship have access to different information about the degree of positive and negative effects. We have seen in the examples throughout this essay that the more precarious or less wealthy participant faces greater negative effects from an economic relationship. They live with those effects, so they are aware of them. Ironically, the participant with less economic bargaining power has access a vast amount of information relevant to a cost-benefit analysis of the relationship. Given their knowledge, their input must dominate the cost-benefit analysis if the analysis is to be considered at all accurate. Many harmful effects of economic relationships would be reduced if every party had equal power in the dictation of terms. Implementation of this bargaining power equality is also utopian because no individual owner of capital is willing to redistribute their economic power. Doing so makes them less competitive with other owners of capital. Remaining competitive is more important for the successful capitalists than fulfilling ethical obligations.

As it stands, the more powerful party can coerce the less powerful using conditions that are external to the market, like poverty and shame. A vulnerability to coercion must be balanced by greater influence in the dictation of terms for a relationship to be mutually beneficial. In cases where one party has no form of legally recognized wealth nor income, the need for sustenance can coerce any terms whatsoever if the terms are physically capable to maintain that person's life. In this case, the potential for coercion is total, with no amount of pain and degradation off the table. Achieving maximized positive effects for both parties is more likely if the person with nothing has full dictation of terms.

Cost-benefit analysis will never achieve objectivity, even if both utopian remedies are adopted. For proof, we only need to consider that economic relationships exist in a network.

Changing one relationship will affect other connected relationships ad infinitum. In the absence of a way to make those connections transparent, no cost-benefit analysis can ever approach completion. The best one can do is forgo the presumption of objectivity and arrogance of certainty. Instead, a genuine analysis will take all measures possible to diversify the decision-making body and delegate control over the process to stakeholders with less economic power.

Power can be used to maintain or create exclusive privileges. While discussing financial inclusion, we must be careful to see that a benefit given to one group can become a privilege if it excludes people. From the start, this paper will push towards an understanding of financial inclusion that does not have barriers and exclusion built in, because that exclusion from financial opportunities is exactly why this paper exists in the first place. The established financial system is built on systems that require privileges to participate. The outcome is an unequal, unjust, and unappealing society.

References

McCarthy, N. 2018. *1.7 Billion Adults Worldwide Do Not Have Access To A Bank Account.* Forbes. Retrieved from*:* *https://www.forbes.com/sites/niallmccarthy/2018/06/08/1-7-billion-adults-worldwide-do-not-have-access-to-a-bank-account-infographic/#363915ed4b01*

ILO. 2018. *More than 60 per cent of the world's employed population are in the informal economy.* Retrieved from: *https://www.ilo.org/global/about-the-ilo/newsroom/news/WCMS_627189/lang--en/index.htm*

eMarketer. 2017. *Mobile Phone Users and Penetration Worldwide, 2015-2020.* Retrieved from*:* *https://www.emarketer.com/Chart/Mobile-Phone-Users-Penetration-Worldwide-2015-2020-billions-of-population-change/196278*

Statistica. 2019. *Smartphone user penetration as percentage of total global population from 2014 to 2021.* Retrieved from: *https://www.statista.com/statistics/203734/global-smartphone-penetration-per-capita-since-2005/*

Forbes. 2018. *The Billionaires 2018.* Retrieved from: *https://www.forbes.com/billionaires/#507d405251c7*

Fraser, N. 2014. *Behind Marx's Hidden Abode: For an Expanded Conception of Capitalism.* New Left Review. 86.

De Soto, H. 2017. *A tale of two civilizations in the era of Facebook and blockchain.* Small Bus Econ 49:729–739. Retrieved from*: https://doi.org/10.1007/s11187-017-9949-4*

2. The Current State of Global Financial Inclusion

The current state of financial inclusion has been summarized by the World Bank for 2017. People have access to finance through four main types of institutions. All four provide has limits on who they can provide access to and what kind of service they can provide. These limitations are set by the media which these institutions use to communicate and coordinate between each of the stakeholders, including everyone from the customers to the owners to everyone in between. Because financial inclusion involves the management of valuable assets including money, the essential problem for every stakeholder of every financial institution is the question of trust. Each person involved needs to be able to trust that their medium of communication is giving them accurate information. They need to know that numbers reflect reality, that promises will be kept, that people are who they claim to be, and so on. The limitations that financial inclusion faces is a question of communicating trust across various mediums of communication or exchange.

The various institutions that provide financial services to people across the world can be divided into four categories. The greatest number of people are served by informal savings groups. The next greatest portion people have financial access through traditional financial institutions like banks…

In 2017, 1.7 billion adults, or 31% of the world's adult population, had no financial services account, whether through a mobile money service provider or at a formal financial institution (World Bank 2017). 69% or 4.9 billion adults did have an account. This figure has increased from 62% in 2014 and 51% in 2011, which indicates a that a growing number of people have access to financial accounts but that the growth is slowing down. People without

accounts can be found across the world in every country, but “nearly half live in just seven developing economies: Bangladesh, China, India, Indonesia, Mexico, Nigeria, and Pakistan” (ibid.). In high-income economies, account ownership stayed relatively constant from 2014 to 2017, at just over 90% of adults.

Having a financial account, whether through mobile money or through a formal institution like a bank, is strongly correlated to educational attainment and employment. Almost half of those without a financial account are unemployed (World Bank 2017). Most have only primary education or less (ibid.).

The World Bank reports that the number of people saving money differs greatly between “high income” and “developing” countries (World Bank 2017). They define high income as any country with per-capita average national income above US$12,056, ignoring the distribution of this income and therefore ignoring the real living standards, wealth and income experienced by large portions of these populations. However, this standard may be used as a crude approximation of living standards or at least typical income in a country. Developing countries would refer to any country with the same figure below US$12,056. About 75% of adults in high income economies saved money in 2016. Close to 45% of adults in developing countries saved money during the same period. The same proportion of adults borrowed money in developing economies, while in high income economies 65% of adults borrowed money.

The following sections will cover a more detailed look at each type of institution, starting with the institutional type which provides the most services.

2.1.1. The state of formal banking

Formal financial account ownership accounts for nearly all of the financial accounts that people have in high income economies (World Bank). A miniscule fraction of accounts are mobile money accounts, and these are almost entirely new since 2014. The World Bank mentions that semiformal savings group information is not collected in high income economies, but it does not provide a reason. One reason might be that formal financial institutions have a much stronger presence, and much larger revenue, in these societies. Semi-formal institutions are not as lucrative for established institutions, so it is in their interest to pretend they don't exist, instead posing formal financial inclusion as the only viable possibility. In addition, semi-formal saving is a form of collective self-empowerment, as will be explored in a following chapter. It is a tradition brought to high income economies by immigrants.

2.1.2. Why formal institutions are not enough

Researchers associated with the World Bank have identified several features of formal financial institutions that tend to limit financial access (Beck et al. 2008). On the side of saving money, customers of formal institutions face minimum account balances that they cannot sustain, account fees that they cannot afford, and identifying documents that they cannot obtain. On the side of borrowing, customers face minimum amounts for loans with long processing times.

Minimum balances, annual fees, minimum amounts for loans, and days to process consumer loans are results of the desire for these institutions to extract revenue from their customers, as well as to recoup the costs associated with the record-keeping required for these accounts. Formal institutions need to store and process information about their customers so that, despite not having extensive personal relationships or knowledge about them, the institutions can

still trust them enough to do business with them. This information is transmitted and accessed via the medium of digital or paper documents. Documents of any kind have costs attached to their effective processing and storage. They need to be accessible to anybody in the organization and possibly to government regulators.

In the context of formal banking institutions, trust in the customers is established through documents created by other formal institutions. For example, state agencies issue government ID, utility companies issue bills to a person's residence, and hospitals issue birth certificates. Institutions trust one another because they issue documents according to established procedures that are known to one another. They can trust that other institutions are telling the truth because they follow legal guidelines and economic incentives. The utility company, for instance, has a strong incentive to determine an accurate address of their customer, or else the customer will not receive their bill or be able to pay for service. Their customer must tell the utility company where they live to receive service, so the utility company is a reliable witness to verify someone's home address. This is how an official utility bill becomes a relevant document to a financial institution. The utility company is credible in its claim to know where their customer lives, because that information is integral to the service that the utility provides as well as to their collection of payments. The bill is a record of this relationship between customer and utility company. The document conveys information that the bank requires to provide its own services to the customer, and it can use the utility bill as a record of the customer's address because the document was created by another institution that the banks knows and has reason to trust.

To obtain an official document usually requires that you already have other official documents. The document and requirements held by formal financial institutions may be

justified as they ensure the smooth functioning of the institution and maximize their profits. However, it structurally excludes people who lack the required privileges. In the United States, the Brennan Center for Justice, in line with several other independent studies, found that over 10% of voting-age citizens did not have government-issued photo ID (Gaskins 2011). The problem is significant among the "elderly, racial and ethnic minorities, immigrants, those with less educational attainment and lower incomes" (ibid.).

Finally, formal financial institutions like banks are not enough because they require physical branches to operate, but these cannot be opened in every accessible location and still be profitable. A physical branch is required because cash, the dominant physical medium of exchange, needs a place to be stored, complex interactions with customers require face-to-face meetings, and identity-verifying documents typically have a physical medium, like a paper bill or plastic ID card. This creates the problem of travelling back and forth to a bank branch in order to use banking services, which becomes impossible for some people in locations that are far from a branch.

2.2.1. The state of mobile banking

The World Bank was clear that mobile phones open up the possibilities for financial inclusion (ibid.). Two thirds of the adults who do not own any formal financial account, which is about 1.1 billion adults, do own a cell phone.

The number of mobile money account holders in Sub-Saharan Africa have increased from 12% of adults in 2014 to 21% in 2017. Half of these people only have a mobile money account, and no bank account. Mobile money accounts have become more popular in West and Southern Africa, while in 2014 they were more concentrated in East Africa. Mobile money

accounts have spread quickly since 2014 in other parts of the world. In 2017, they were held by 14% of adults in Haiti, 21% in Bangladesh, close to 20% in Chile, the Islamic Republic of Iran, and Mongolia, 29% in Paraguay, and 16% in Turkey. Outside of these regions, most new financial accounts were in formal financial institutions.

The World Bank irresponsibly suggests that if governments across the world paid public sector wages, pensions, and transfers to digital accounts instead of in cash, then up to 100 million people could become "banked," which means having a formal financial account (ibid.). It does not suggest buying phones for these recipients, only two thirds of whom already have cell phones. It also claims that the private sector digitizing wages could "bank" 230 million adults, of whom 78% have cell phones. What the authors fail to acknowledge is that these unilateral decisions made by government and private institutions would be forcing people to use digital money without addressing the myriad ways that this imposition could be harmful. Digital money has several barriers to use that will be examined in the next chapter. This unilateral decision could hide beneath the veneer of "doing good" while making many people's lives harder, with little to no tangible benefit for them. The tangible benefit that such blanket digitization would bring is to government tax agencies, who could tax the unbanked more effectively. Another tangible benefit would go to formal financial institutions, who would now have access to the personal savings of many more people. Such digitization could potentially make sense in paying wages for high-income public employees, who would have extensive savings anyway, and who could not face substantial harm from the initiative. A broader initiative would require specialized cell phones being provided free of charge to public employees and would require the creation of a widespread network of agents, like those associated with M-Pesa. This digitization of public

wages, along with digitizing payments made within the government and those made by the government to private institutions, would help with identifying corruption by ensuring that government money is tracked in potential incorruptible digital records.

The World Bank makes a questionably valuable observation on the potential for digital payments to benefit agricultural producers (ibid.). Digitizing these payments would help agricultural producers to build payment histories, expanding access to credit and insurance for small farmers. There are 235 million unbanked adults currently receiving cash payments for their agricultural goods, and 59% of them have phones. While this is good for the farmers who acquire this access through their phones, the other 41% would remain their competitors. By strengthening their competitors, this 41%, or 96 million adults, could potentially be hurt by the initiative. On the other hand, in some cases, the 41% will benefit because increasing output from their region could spur investment in trade infrastructure, which could have positive externalities for all farmers in the area. In short, while the effect is likely positive in many cases, caution is useful in all cases.

2.2.2. Why mobile banking is not enough

Opening a mobile money account requires a government-issued ID card. In Kenya, national ID cards are common, but many people, especially cannot obtain one (Opinion Leaders 2016). A birth certificate is needed to prove Kenyan citizenship, and the identity cards or birth certificates of the applicant's parents are also required (Taji 2018). To open an account using M-Pesa, new users approach a certified M-Pesa agent operating in their area and present their ID. The agent helps the user fill out a form including basic information like name and age, making the process accessible to illiterate users as well (Mas & Morawczynski 2009). As of 2018,

first-time applicants are not required to pay a fee (State 2018). Obtaining a government ID card and living close to an agent are the only requirements for opening a mobile money account.

According to Safaricom, the company that runs M-Pesa, the increasing popularity of M-Pesa has let to more fraud in which people steal identity cards and pose as the stolen identity (Donkin 2017). In response, in 2017 they began a program to check every withdrawal and deposit of mobile money against a database of photographs of the account owner, which are taken at every transaction with an agent as well as at registration (Mutegi 2017).

Once again with mobile-money-based banking, as with formal banking institutions, the major barriers of inclusion are linked to the requirements of establishing trust between the institutions providing financial services and the users, who are in most cases complete strangers to the people operating the banking institution. The necessary trust is established using formal identification, but more generally using reliable records that must be stored, maintained, and verified regularly. Photographs of customer's faces record are kept and referenced each time a customer needs to make a transaction through an agent because the agent is a stranger. The records of physical interaction are used to approximate the kind of knowledge that the agent might have if they knew the customer personally. The customer's circle of friends, acquaintances and family know their face well and can tell them apart from anyone who would try to impersonate them. The mobile money institutions does not have that personal relationship on which to base their trust, so have with some success simulated that knowledge instead.

The information about a person's identity beyond their interaction with the mobile banking service cannot be simulated without direct personal knowledge of the customer, and so the basis for that trust must be a government ID, which is a record that, at one point, the

customer proved their identity to a trustworthy government agency well enough that the government is willing to stake some of its reputation on providing a tangible record that it considers the information on the ID card to be true. If the government had no reliable standards on which to judge whether a person would receive an ID card, the agency responsible would quickly lose its credibility and the ID card would be without value. In the presence of reliable standards, the identified person can carry their ID card with them as a record that they went through the government-endorsed process of identity verification. Records such as the government ID or the database of photos mediate trust by transmitting reliable information across time and place about an individual. Records convey knowledge about an individual's interactions with institutions or, at a more basic level, with people.

Using mobile money also requires owning and using a cell phone with service. Mobile money is a digital medium of exchange, so it requires a digital platform. Cell phones are the cheapest, most appropriate and widespread. The accessibility of cell phones will be expanded upon in the next chapter. Chapter 3 will analyze in depth the barriers which hold people back from having access or being able to use cell phones. Although there exist tentative answers to almost any challenge, the one factor which lacks is a profit motive to address these barriers. That motive may not exist because the infrastructure is not yet there to make universal cell phone access a profitable venture, potential customers simply may not have enough money to justify the investments required, or they may not have enough money to purchase a phone with service. Whatever the case may be in different contexts, there is always and everywhere a financial investment involved for anyone to have access to cell phones and mobile money. As long as

some groups of people cannot built wealth within their community, the necessary investment cannot be made in a context where cell phone access is organized through markets.

2.3. A fundamental impossibility of financial inclusion

The World Bank surveyed people without any financial account, either through mobile money or a formal institution. Two thirds of people who responded said that they had too little money to have an account (World Bank 2017). Only about half of the world population reported saving money last year in 2016. At a certain point, someone can have so little money to save that they have no way to save money, no way to pay interest on loans, and can simply not obtain any benefits from financial inclusion. This is no longer a problem of financial access. At this extreme, this is a problem of a economic and social systems which divides the surplus of global production in such a way that some people have no way to improve their quality of life over time or the quality of life of their children and families. They can buy nothing except the necessities of life. An understanding of the contradictions, deceptions and flaws within economic and political systems is the only way to envision a solution to this problem. However, such a solution does not yet exist with any consensus.

References

Opinion Leaders. 2016. *Kenyans without IDs and birth certificates must not suffer any longer.* Capital FM. Retrived from https://www.capitalfm.co.ke/eblog/2016/01/25/kenyans-without-ids-birth-certificates-must-not-suffer-any-longer/

Taji, P. 2018. *How to Apply for Kenyan ID online.* Tuko. Retrieved from https://www.tuko.co.ke/274002-how-apply-kenyan-id-online.html#274002

State Department for Immigration, Border Control and Registration of Persons [website]. *National Registration Bureau.* Retrieved from http://immigration.go.ke/national-registration-bureau/

Donkin, C. 2017. *Safaricom looks to photo ID to curb m-Pesa fraud.* Mobile World Live. Retrieved from https://www.mobileworldlive.com/money/news-money/safaricom-looks-to-photo-id-to-curb-m-pesa-fraud/

Mutegi, M. 2017. How M-Pesa agents will be using photos to verify your identity. Nairobi News. Retrieved from https://nairobinews.nation.co.ke/news/m-pesa-agents-photos-verify-identity

Gaskins, K. 2011. *Debunking Misinformation on Photo ID.* Brennan Center for Justice. Retrieved from https://www.brennancenter.org/blog/debunking-misinformation-photo-id

3. Mobile Adoption and Accessibility

"If you build it, they will come," goes the famous quote that entrepreneurs and innovators everywhere find appealing. If one is designing a system for financial inclusion, and that system is based on something as seemingly ubiquitous as the simple cell phone, the quote might seem applicable. Unfortunately, there are countless barriers that prevent people from having access to cell phones. Any serious discussion of achieving broad financial inclusion without excluding enormous numbers of people will have to address these barriers.

The appeal of mobile financial services over traditional in-person financial services is that they can reach far more people. However, these efforts are limited by the number of people who can use them. Any form of media that aims to influence society will be limited by its accessibility. If someone cannot access the media, or if they cannot use the media, then they will not personally benefit from it. If many people in a community cannot access or use the media involved in a digital financial inclusion initiative, then their community will not receive the full benefits of inclusion. The community will only be partially included. They can easily fall behind other communities which experience more complete inclusion. As we explored in the introduction, this imbalance can be detrimental to the people who are most vulnerable.

For people to use digital financial services, they need to have access to the service and they need to be able to use it. A quick summary of the barriers to adoption can start with the physical accessibility of a working cell phone. Typically, this means that a potential user must have the money to buy a cell phone with wireless service. The phone needs to have the right technical specifications to run the financial application. The user's region needs to have

infrastructure for wireless service. There are several barriers to the construction of network infrastructure. The region might not profitable enough to justify the investment in the eyes of either the public or private sector. The profitability of wireless network infrastructure in a region comes down to whether the revenue from users in the region outweighs the cost of construction. Revenue from a region can be low because it is populated by people with income that is too low for them to purchase phones, or because the region is sparsely populated. The cost of construction might be higher if the region is rugged, mountainous, swampy, or in some other way difficult to build on. Once infrastructure is constructed, it must be kept in working condition and replaced as necessary, which requires employed professionals with the appropriate skills. Finally, the users of a financial application need access to electricity. People need to charge their phones, and the network infrastructure requires power. All of these requirements are necessary before a mobile financial service can reach a potential user.

Even if someone has access to a digital financial service, there are barriers to them using it. The service needs to provide a positive user experience, or else people will not have a reason to use it. The service needs to be self-explanatory to people who might be completely inexperienced with using cell phones. More likely, the user needs to be taught how to use the service. The user needs to be able to understand the information presented on the service. If the user is illiterate, they cannot use a strictly text-based app. If the user has poor vision because they are blind, old, or any other reason, they cannot use an app that relies solely on the screen to convey information. A user needs to be able to use a digital financial service before they can begin to consider whether it is valuable to their life. Finally, the benefit of the service must be

greater than the burden of using it. The more a service blends seamlessly into the user's life, the more likely they are to choose to use it.

3.1. Current Cell Phone Ownership by Geography

Digital financial services and mobile money require a mobile phone as a platform. A system of financial inclusion that targets individuals are limited by the number of people who own phones. According to research published by Statista, cell phone adoption was estimated to be 63% of the global population in 2016 (Statista – Mobile 2019). The figure was estimated to reach 67% in 2019. Smartphone adoption was at 29.5% in 2016 and projected to increase to 36.8% in 2019 (Statista Smartphone 2017). For context, 65% of the world population was between the ages of 15 and 64 in 2017, 26% were children 14 and under, and 9% were above the age of 64 (World Bank – Population 2017).

For further illustration of the prevalence of mobile phones in the world, we can look at data from different countries and draw conclusions about the relationship between the development of a society and its mobile phone adoption. First, we can look at data from Tanzania and Senegal. These countries are selected because data is readily available on cell phone adoption in these countries, and in this discussion, they can represent the state of adoption in low-income regions. Both countries are on the United Nations list of "Least Developed Countries", a list of "low-income countries confronting severe structural impediments to sustainable development" (United Nations Development Programme 2017).

For a rough estimation of general living conditions or development within these countries, I will reference their inequality-adjusted Human Development Indexes (IHDI). The IHDI measures the knowledge, health, and wealth of a population by measuring the average

years of schooling, life expectancy at birth, and total national income (GNI) per person, adjusts for inequality in these numbers to capture an approximately typical person's quality of life. The index theoretically ranges from 0 to 1. The lowest score is held by the Central African Republic at 0.212, while the highest score is held by Iceland at 0.878 (UN HDI 2018).

Senegal has an IHDI of 0.340 and Tanzania has an IHDI of 0.404. In this measure they are respectively ranked 128 and 115 out of 151. Senegal has greater mobile phone penetration: 79% of adults reported owning a mobile phone in 2017 compared to 75% in Tanzania (Silver 2017). Smart phones are far less common than basic phones: 30% of Senegalese adults and 13% of Tanzanian adults had a smart phone.

In the Central African Republic (CAR), with the lowest IHDI in the world, 11% percent of the population has a cell phone subscription, compared to 42% and 53% for Tanzania and Senegal, respectively (GSMA 2017). Tanzania's low subscriptions per total population compared to Senegal is explained by its young demographic. 45% of the population is below the age of 15 (World Population Review 2019). According to the CIA World Factbook, the median age in CAR is roughly midway between Tanzania and Senegal. From these figures, we can estimate that the portion of adults in the Central African Republic with a mobile phone is approximately 20-25%. The number of cell phone subscriptions per citizen has been stagnant in Senegal since 2014 (Statista Senegal 2017). Subscriptions peaked in 2013 in the CAR, the year when rebels captured the capital city of Bangui (Statista CAR 2017). Subscriptions declined by 17% in 2014 and have remained relatively stagnant in the following years (ibid). Note that there are more cell phone subscriptions in the world than people, so while subscriptions are useful for looking at growth in cell phone adoption, they do not represent individual users. It is clear that future

growth of the number of cell phone users in a given region cannot be assumed, as the number has shown to be stagnant in the case of Senegal and the CAR.

The data above makes it clear that while mobile phone adoption among adults are high in low-income regions, significant fractions of their population remain without cell phones. A small set of very undeveloped countries have very low mobile phone adoption. Across low-income regions in general, smartphone adoption is uncommon.

Mobile adoption data is abundant in the U.S. The U.S. has an IHDI of 0.797, ranked 25 out of 151. There, 95% of adults have mobile phones and 77% of adults specifically have smartphones (Pew US 2018). While the vast majority of the adult population in developed countries like the United States have mobile phones, a significant portion is still without smartphones.

Kenya, Pakistan, India and China will be analyzed in more detail later in this paper, so I will note their mobile phone adoption. Their IHDI are 0.434, 0.387, 0.468, and 0.643, respectively.

- China's cell phone adoption is at 80%. Smartphone adoption there is 60% of the population.
- In Pakistan, 60% of the population have a mobile phones and 13% of the population have smart phone.
- The 2018 GSMA Mobile Economy Report puts Kenya's number of unique mobile subscribers at 29.6 million, which was 60% of the population (Mboya 2018). Smartphone adoption was at 22%.

- India Infoline News Services reported that 65%-75% of the Indian population owned a cell phone in 2017 (IIFL 2017). eMarketer predicted that a quarter of the Indian population would have a smartphone in 2018 (eMarketer 2018).

3.2. General barriers to mobile phone ownership evident in demographic data

By looking at demographic differences in mobile phone ownership, we can identify barriers to owning a mobile phone. Across a sample of six African countries, we see that in most countries, men are more likely than women to own a mobile phone (Pew Africa 2017). In South Africa there is no difference, in Kenya men are 4% more likely, and in other countries the difference is between 11% and 17% percentage points. In all six countries, younger adults are slightly more likely to own a mobile phone than older adults. Having an income above the national median makes people between 6% and 18% more likely to have a phone in these countries. In Kenya, the difference is 7%. In all countries except South Africa, the greatest difference in mobile phone ownership is based on whether a person has completed at least secondary education. Except for South Africa, where the difference is 7%, having completed secondary education or higher means a person is between 18% and 31% more likely to own a mobile phone. In Kenya, the difference is 21%. In all six countries, over 90% of adults who have completed at least a secondary education have a mobile phone. In Kenya, this figure is 95%.

In the United States, where mobile phone ownership is very high, the greatest demographic difference in ownership is between younger and older adults (Pew US 2018). 100% of adults between 18 and 29 have cell phones, while 85% of adults over 65 have a cell phone. The gender gap in the U.S. is very small, with 95% of men and 94% of women owning a mobile phone, though there is a 5% difference for smartphone ownership. Education has an effect on the

likelihood: mobile phone ownership ranges from 90% of those who didn't complete high school to 97% for college graduates. 92% of adults earning less than $30,000 a year, approximately the median personal income in the United States, have mobile phones. The figure is 98% for all other income categories. Rural adults are less likely to have a mobile phone than urban adults. Although mobile phone ownership is very common among American adults, we see from the data that ownership is least likely for adults older than 65 (85%), Adults who did not attend any college (90-92%), adults earning less than the median income (92%) and rural adults (91%).

These same divides are much more apparent in smartphone ownership. While 94% of adults 18-29 have a smartphone, only 46% of adults over 65 have them. 57% of adults who did not graduate high school have a cell phone, compared to 69% of high school graduates and 91% of college graduates. 67% of adults earning below $30,000 have a smartphone, compared to 93% of those earning above $75,000. While 83% of urban adults have smartphones, only 65% of rural adults have the same. Even in a highly developed nation such the United States, there are large divides in smartphone ownership among different groups of people.

In all parts of the world, we see that access to a mobile phone is far from a universal right. Instead, mobile phone ownership in general is a privilege. Mobile phone ownership is connected to other privileges, such as male privilege, income level derived from the labor markets to which a worker has access, and most significantly level of education. That said, large swaths of most societies own mobile phones. The divide along lines of privilege are far more evident in the adoption of smartphones. Building a financial inclusion application for either basic cell phones or for smart phones always means creating a privilege that not everyone will have.

3.3. Gender exclusion

Fewer women than men own cell phones in every region of the world. The region of Latin America and the Caribbean has the smallest gender gap in mobile ownership at 3% (Burjorjee 2018). In this region, women with the least education, a maximum of 5 years of education, earn 80% of comparable men's earnings (Moloney 2016). Women with over 13 years of schooling were earning 26% less than comparable men. This suggests that despite the fact that women have significantly less disposable income, cell phones are considered important enough of a purchase across income levels that the gender gap in phone ownership is relatively small. Still, since mobile phone ownership costs the same regardless of gender, women are paying a higher portion of their income to own a phone.

In other regions, the gender wage gap is much higher, combining with other social factors to create a large gender gap in mobile phone ownership. According to the Gallop World Poll 2016, "in Pakistan, 86 percent of men have a mobile phone, compared with 27 percent of women" (Burjorjee 2018). This is a gap of over 30%. The gender wage gap is higher in Pakistan than in any other country, with women earning 44% less than men on average (Lohano 2018). For women working part-time jobs, their pay gap is even higher, earning 77% less than men in part-time jobs. Women across the world do domestic work without pay, and the time taken by this work means many women need to take part-time positions instead of working full-time. This is even more likely in households where the extra income from part-time work is necessary. CGAP, which describes itself as a "global partnership of 34 leading organizations that seek to advance financial inclusion", identifies several barriers for women to access mobile financial services. One of the major barriers identified are "local legal, social, and cultural norms, such as fear that open access will make women vulnerable to harassment or impair sound

decision-making" (Burborjee 2018). On the more technical side of financial inclusion, many mobile money providers and banks require some form of ID to open an account. As CGAP reports, "women and girls face distinct challenges in obtaining official identification".

3.4. Literacy

A mobile phone is only the first requirement for having digital access to the financial system. Several other factors in a mobile phone owner's life determine whether they have the motivation, the knowledge, and the skills necessary to use a digital application effectively.

Nearly 14% of people older than 15 are illiterate (Our World in Data 2018). People remain illiterate when they do not have access to public education, which is especially the case when their community or local government is lacking in resources for public spending. Children from economically stressed families are more likely to perform worse in school cite. Literacy is also a gender issue. In some communities, girls are expected to do domestic work instead of attending school, and in some cases, families face intimidation if their daughters attend public school. A culture of inclusive primary education is necessary to ensure widespread literacy, which is essential for using most mobile phones.

A study of illiterate people using digital technologies emphasized the user should ideally be involved "throughout the design process" (Lalji 2008). The user's input helps while "progressively testing and fine-tuning the prototypes by exposing the shortcomings and strengths in the design".

Illiterate phone users have many strategies for navigating the features of a mobile phone. People often rely on some form of rote memorization (Knoche 2012), according to a study done with illiterate Swiss immigrants. Family members who are literate might teach the illiterate user

the steps necessary to use the features of their phone. The numbers of contacts can be saved with a certain icon or picture, which the illiterate user can identify. Illiterate users made some use of text in the phone interface, using the length or appearance of text as markers, or using the first letter of a contact name (typed in by somebody else) to search a contacts list. These users also use strategies to save numbers of business cards, or paper notes distinguishable by appearance. Illiterate phone users typically required outside help to read text messages, learned how to call back the SMS sender, or else simply treated all text messages as spam. These phones did not have features that would read out text messages. Current generations of smartphones generally have this feature.

The study pointed out that phones are status symbols and any indication that the user is illiterate carries a stigma. For example, the Motofone F3 had an e-ink screen visible in sunlight, a 30-day battery life on standby, cost only 20USD, and provided audio feedback for all of its features. A source in Motorola pinned the failure of the device in Switzerland on the fact that people did not want to be seen with a cheap phone.

The recommended design features, keeping in mind that some users of a mobile phone will be illiterate, were “optional text-to-speech throughout the interface especially for SMS, OCR-to-speech,” and increased use of voice notes. Voice control is another useful feature for these phones. Removing text entirely from an interface was noted to make it more difficult for literate people to help illiterate users learn how to use the phone, contributed to stigma, and was less valuable to semi-literate people who value exposure to text. In general, illiterate people prefer to use the same phones as everyone else and prefer user interfaces which have better accessibility features and use icons throughout the phone’s features. Since these features can

generally be implemented without detracting from the experience of literate users, they can be recommended in general for all phones. Such features will greatly help people with all levels of education to make use of their phones for financial inclusion.

3.5. Language barriers – India case study

Literacy is not only a question of education but also a question of language. If a user of a mobile phone is not good at reading the language of the phone menus or financial application, they will face the same problem as people who generally cannot read.

Language barriers are a significant reality in many parts of the world. In India, for instance, Hindi is the official language of the state and English is the official sub-language (New World Encyclopedia 2018). However, only 44% of Indians speak Hindi according to the most recent census (Census of India 2011). The Constitution of India recognizes 22 major regional languages (Constitution of India 2007). The 1991 census recognized over 1,500 languages and dialects in India. In 2011, fifteen languages, including Hindi and English, each had more than 10 million native speakers. Eighteen more languages on top of that have over a million native speakers. The rest of the Indian languages are the mother tongues of roughly 3 million people.

The Indian federal government gave phone manufacturers until February 2018 to make sure that phones sold in India had support for Indian languages (Estopace 2017). Phones had to allow text input in English, Hindi, and at least one other Indian official language. Phones also need to be able to read messages in all 22 official languages. The reason given is that text messages are useful for the government to communicate with the public about “education, health, and welfare.”

Many phone manufacturers go to market already supporting a large number of languages for the interfaces of their phones (Estopace 2017). Samsung phones, for instance, support 14 Indian languages. A feature phone released by Jio in 2017 supports 22 languages for its interface and costs 1,500 Indian Rupee, which at time of writing is worth about 20 USD. Plans for unlimited calling and 1GB of data per month are offered for 49R, less than 1 USD. Users can use voice commands in English or Hindi to write text messages, open apps, or searching on Google. Jio captured 97% of the feature phone market in 2017, shipping 19 million phones, and shipped 40 million in 2018 (Khan 2018). Clearly, phones that provide accessibility options for people's native languages prove to be marketable.

Google announced in late 2018 that Google Assistant would soon allow users to dictate text and search in Marathi, Hindi, and 7 other Indian languages (Behar 2018). Google searches would turn up results in either English or Hindi and Maps would also begin supporting Hindi. Google announced it was also working on a feature that could read webpages in "smooth, natural sounding voice, even on 2G" in five major Indian languages. In short, major phone manufacturers have not yet made their products accessible in the overwhelming majority of Indian mother tongues. These companies are making some progress, and some are seeing large demand for their accessible products. However, the text interfaces in all of these products fall short of supporting even the 22 official languages of India. The process of supporting new languages involves, according to Google, working with native speakers to collect speech samples (Pahwa 2017).

Google and Google Assistant for the Android smartphone operating system can hardly be treated as the current standard in India. The sale of feature phones there doubled between early

2017 and early 2018 while sales of smartphones showed no growth, adding up to a total 48% increase in cell phone sales (Jain 2018). Forbes reported in 2016 that while a billion Indians held a mobile phone subscription, only 125 million had a smartphone (Rai 2016). However, feature phones are currently emerging as a major portion of the mobile phone market with features that rival smartphones. In 2018, Google invested over $20 million in KaiOS, a Linux-based operating system for feature phones (Charuasia 2018). KaiOS operating systems are used on phones made by Nokia and Reliance Jio, as well as several other manufacturers like Sprint and AT&T. These phones offer 4g connectivity, WhatsApp, Facebook, and Google Search, while Google's new partnership entails that Maps, YouTube, and Google Assistant will also be included (Gershgorn 2018). These feature phones offer many of the tools that have been typically associated with smartphones. Using a feature phone loaded with Google Assistant available in your language means that you can control almost all aspects of your phone using only your voice, from sending texts and making calls to opening and operating apps.

The artificial intelligence that runs Assistant has typically required fast processors that are challenging to implement in feature phones. However, research across the industry is making this AI far more efficient, even to the point of being able to fit on a phone. For example, in 2016, Facebook AI Research publish open-source code for a very lightweight language recognition (Bojanowski 2016). If this AI fits on a phone, then users do not need to use their network connection to use tools like Google Assistant. Even if it does not fit, this process now requires much less data.

At this point, a reader might wonder why we are talking about translated voice control and voice interfaces, instead of talking about translated text interfaces. A translated text interface would not require complex artificial intelligence algorithms.

3.6. Mobile connections for disconnected areas

Many rural regions do not have the network infrastructure that would be required for phone or internet connectivity. There is a great amount of research dedicated to analyzing the problem of bringing cellular and internet service remote, rural locations.

One of the major issues tackled by this literature is that rural areas often lack reliable and inexpensive electricity (Abdelrahman 2017). These regions can be off the centralized electric grid, which itself requires massive infrastructure. Therefore, most of literature focusses on powering network technology with self-sufficient renewable energy. This body of research identifies many novel ways of ensuring satisfying levels of coverage, which is a significant task in a network of small-scale energy production units (like solar panels) and low-powered network antennas.

Research conducted by members of the Institute of Electrical and Electronics Engineers provided examples of several technologies which can be used to provide access to a cellular network in rural regions (Abdelrahman 2017):

1. Energy-efficient “base stations” have a fixed location, can be powered with renewable energy, and uses standard radio signals.

2. An even more cost-effective fixed-position option is to use long-range, high-powered WiFi stations. These have been successfully deployed in rural regions in the Scottish Highlands, India, Senegal, Haiti, Kenya, Senegal, among other locations.
    a. Long-range WiFi uses the "white space" spectrum, which refers to unused parts of the radio spectrum (Gilpin 2014). This part of the spectrum is similar to that used by 4G. White Space broadband can travel through vegetation and buildings, up to 10 kilometers (ibid.). Google and Microsoft have launched projects to use White Space in Africa and the FCC is supporting White Space development in the United States (ibid.). White Space could provide an effective, low-cost network signal across rural regions and underserved urban areas.
3. Some people require a mobile solution rather than a fixed solution. Natural disasters can destroy fixed network infrastructure. Some populations move seasonally for water, food, and work opportunities. Mobile cell sites are a response to these needs. Antennas can be mounted on cars and trucks, powered by their engines (ibid.). Low-altitude balloons and kites can extend the range of ground antennas and are useful in emergency situations. High-altitude platforms can provide coverage over very large areas but require heavy investment (ibid.).

Each of these technologies involve a network of nodes, where each "node" is a network antenna with a power source. The nodes are distributed across a region, wherever they are needed, purchased and set up. Each node connects to one another through "hops". They transmit signals to each other, one after another, until the signals reach a cell tower connected to the

broader network. The system is called a “multi-hop relay” and is covered in detail in a large body of research (Wan 2009) (Darbari et al. 2010) (Zaidi 2017).

3.7. Converting between cash and mobile money - China and Kenya case studies

Mobile money requires more than just the infrastructure necessary for cell phone use. Mobile money also requires a network of people who can exchange the mobile money for cash. For as long as some people do not have mobile money, goods and services providers like stores will need to support cash or else exclude a vulnerable population from purchasing the things they may need and want. For as long as some goods or service providers do not accept mobile money, consumers will require the ability to convert their mobile money into cash and back again as needed.

3.7.1. Freedom of choice of payment options – China case study

China provides a case study for an economy that is moving quickly towards universal mobile payments. Mobile payments are made by scanning a QR code sticker to find the right address to send money, then paying using Alipay or Tencent (Zhong 2018). These mobile payments providers require connection to a bank account, yet close to 500 million Chinese citizens were registered with a mobile money provider in 2017 (ibid.). Stores in Chinese cities have started to only accept digital money and have stopped accepting cash. Complaints have “mostly involve parking lots and small supermarkets, food street shops,” and other such small businesses (Xinhuanet 2018). The People’s Bank of China has publicly advised that it is illegal not to accept cash in exchange for goods and services (ibid.). Their given reasons were both to protect the rights of those without access to mobile money and to preserve the state’s sovereign of control of the money supply.

3.7.1. Ease of converting between cash and mobile money – Kenya case study

Kenya provides and example of widespread mobile money where users report that converting to cash and back is convenient.

Safaricom states that there are over 40,000 agents in the country, which is close to one agent for every thousand citizens (Safaricom 2019). Agents help people sign up for M-Pesa accounts and make deposits or withdrawals. They earn a percentage of each transaction value, which incentivizes them to be regularly available and develop relationships of trust with their customers. Now that M-Pesa has been established for several years, agents have become highly reliable, with 88% of M-Pesa users rating the service at least an 8 out of 10 and 95% trusting their local agent (Jack 2011). The convenience of converting between cash and M-Pesa through this network has room for improvement, but largely functional. Within a year, 16% of M-Pesa users had experienced delays to withdraw money from M-Pesa (ibid.). Of those, 81% were solved within a day. The majority of those delays were from the Safaricom network going down and a third of them were because agents had run out of money.

References

2019. *Number of mobile phone users worldwide from 2015 to 2020 (in billions).* Statista. Retrieved from https://www.statista.com/statistics/274774/forecast-of-mobile-phone-users-worldwide/

2017. *Population ages 0-14 (% of total).* World Bank Group. Retrieved from https://data.worldbank.org/indicator/SP.POP.0014.TO.ZS

2017. *ICT Facts and Figures 2017.* International Telecommunications Union. Retrieved from https://www.itu.int/en/ITU-D/Statistics/Pages/facts/default.aspx

Least Developed Countries (LDCs). United Nations: Economic Analysis and Policy Division. Retrieved from: https://www.un.org/development/desa/dpad/least-developed-country-category.html

United Nations Development Programme. 2018. *Human Development Reports: Table 3: Inequality-adjusted Human Development Index.* Retrieved from: http://hdr.undp.org/en/composite/IHDI

GSMA. 2017. *The Mobile Economy Sub-Saharan Africa 2017*. Retrieved from: https://webcache.googleusercontent.com/search?q=cache:fSaq2XpfjOwJ:https://www.gsmaintelligence.com/research/%3Ffile%3D7bf3592e6d750144e58d9dcfac6adfab%26download+&cd=1&hl=en&ct=clnk&gl=us

Silver, L. & C. Johnson. 2018. *Internet Connectivity seen as having a positive impact on life in Sub-Saharan Africa*. Pew Research Center: Global Attitudes and Trends. Retrieved from: http://www.pewglobal.org/2018/10/09/majorities-in-sub-saharan-africa-own-mobile-phones-but-smartphone-adoption-is-modest/

World Population Review. 2019. *Tanzania Population 2019*. Retrieved from: http://worldpopulationreview.com/countries/tanzania-population/

Statista. 2017. *Number of mobile cellular subscriptions per 100 inhabitants in Senegal from 2000 to 2017*. Retrieved from: https://www.statista.com/statistics/510573/mobile-cellular-subscriptions-per-100-inhabitants-in-senegal/

Statista. 2017. *Number of mobile cellular subscriptions per 100 inhabitants in the Central African Republic from 2000 to 2016*. Retrieved from: https://www.statista.com/statistics/501976/mobile-cellular-subscriptions-per-100-inhabitants-in-central-african-republic/

Statista. 2017. *Smartphone user penetration as percentage of total global population from 2014 to 2021*. Retrieved from: https://www.statista.com/statistics/203734/global-smartphone-penetration-per-capita-since-2005/

Pew US. 2018. *Mobile Fact Sheet.* Retrieved from: http://www.pewinternet.org/fact-sheet/mobile/

Burjorjee, D. & Y. Bin-Humam. 2018. *New Insights on Women's Mobile Phone Ownership*. CGAP.

Our World in Data. 2018. Retrieved from: https://ourworldindata.org/literacy

Moloney, A. 2016. *Latin America gender pay gap shrinks slowly, harms development - UN*. Reuters. Retrieved from: http://news.trust.org/item/20160310180333-qeehd/

Lohano, H. 2018. *Wage growth and gender pay gap in Pakistan.* The Express Tribune. Retrieved from: https://tribune.com.pk/story/1872135/6-wage-growth-gender-pay-gap-pakistan/

Census of India. 2011. Retrieved from: http://www.censusindia.gov.in/2011Census/Language-2011/Statement-1.pdf

Lalji, Z. & J. Good. 2008. *Designing new technologies for illiterate populations: A study in mobile phone interface design.* Interacting with Computers, Volume 20, Issue 6, December 2008, Pages 574–586. Retrieved from: https://academic.oup.com/iwc/article-abstract/20/6/574/671240

Knoche, H. & J. Huang. 2012. *Text is not the enemy: How illiterates' use their mobile phones.* ResearchGate. Retrieved from: https://www.researchgate.net/publication/266595198_Text_is_not_the_enemy_How_illiterates'_use_their_mobile_phones

Estopace, E. 2017. *India Gives Phone Manufacturers Until Early 2018 to Support 22 Official Languages.* Slator. Retrieved from:

https://slator.com/demand-drivers/india-gives-phone-manufacturers-early-2018-support-22-official-languages/

Constitution of India. 2007. Retrieved from: https://web.archive.org/web/20140621134720/http://lawmin.nic.in/coi/coiason29july08.pdf

Khan, D. 2018. *JioPhone dominated 4G feature phone segment to rapidly expand in 2018 with new OS and devices*. ET Telecom. Retrieved from: https://telecom.economictimes.indiatimes.com/news/jiophone-dominated-4g-feature-phone-segment-to-rapidly-expand-in-2018-with-new-os-and-devices/63579550

Behar, R. 2018. *Google products in India are gaining support for more languages.* Android Police. Retrieved from: https://www.androidpolice.com/2018/08/28/google-for-india-new-languages-third-party-app-support/

Pahwa, N. 2017. *Google adds voice search in 8 Indian languages; Where this is going…* Medianama. Retrieved from: https://www.medianama.com/2017/08/223-google-adds-voice-search-indian-languages/

Chaurasia, S. 2018. *Not dumb anymore: Riding on new tech, feature phone challenges smartphone's clout.* The Economic Times. Retrieved from: https://economictimes.indiatimes.com/tech/hardware/not-dumb-anymore-riding-on-new-tech-feature-phones-challenge-smartphones-clout/articleshow/65161086.cms

Gershgorn, D. 2018. *The best of Google's Android is coming to cheap feature phones.* Quartz. Retrieved from: https://qz.com/1318961/google-is-bringing-the-best-of-android-to-cheap-feature-phones/

Jain, A. 2018. *India Feature Phone Market doubled while the Smartphone Market remained flat YoY in Q1 2018*. Counterpoint. Retrieved from: https://www.counterpointresearch.com/india-feature-phone-market-doubled-smartphone-market-remained-flat-yoy-q1-2018/

Rai, S. 2016. *India Just Crossed 1 Billion Mobile Subscribers Milestone And The Excitement's Just Beginning.* Retrieved from: https://www.forbes.com/sites/saritharai/2016/01/06/india-just-crossed-1-billion-mobile-subscribers-milestone-and-the-excitements-just-beginning/#4ebdb147db0b

Gilpin, L. 2014. *White Space, the next internet disruption: 10 things to know.*

Wan, S. 2009. *Wireless Networks in Rural Areas: Challenges and Solutions.*

Darbari, F. et al. 2010. *Practical aspects of broadband access for rural communities using a cost and power efficient multi-hop/relay network.*

Zaidi, Z. & KC. Lan. 2017. *Wireless multihop backhauls for rural areas: A preliminary study.* Retrieved from: https://www.ncbi.nlm.nih.gov/pubmed/28403167

Xinhuanet. 2018. *Rejecting RMB cash is illegal! Here will carry out centralized rectification.* Retrieved from: http://www.xinhuanet.com/legal/2018-08/19/c_1123292771.htm

Safaricom. 2019. *Experience M-PESA.* Retrieved from: https://www.safaricom.co.ke/personal/m-pesa/getting-started/experience-m-pesa

Mboya, E. 2018. *Kenya beating African peers in mobile subscription growth.* Business Daily. Retrieved from: https://www.businessdailyafrica.com/corporate/tech/Kenya-beating-African-peers-in-mobile-subscription-growth/4258474-4681330-457vl9z/index.html

eMarketer. 2018. *More than a Quarter of India's Population Will Be Smartphone Users This Year.* Retrieved from: https://www.emarketer.com/content/more-than-a-quarter-of-india-s-population-will-be-smartphone-users-this-year

IIFL. 2017. *Mobile phone penetration in India set to rise to 85-90 % by 2020.* Retrieved from: https://www.indiainfoline.com/article/news-top-story/mobile-phone-penetration-mobile-phone-penetration-in-india-set-to-rise-to-85-90-by-2020-117051800423_1.html

4. Decentralizing Investment

Digital currencies like M-Pesa have for the first time created affordable and nearly instant remittances. These allow rural households to benefit from urban wages by using digital technology to support connections between family members and friends across long distances. However, when one speaks of financial inclusion, they are not only talking about the ability to enjoy higher wages. Financial inclusion implies the ability to borrow and invest, to start businesses and hold assets. While wages provide steady incomes and allow households to save money over time, full financial inclusion unleashes a wide range of economic activity with the potential to multiply the wealth of individuals and communities. The ability to receive loans to start businesses, to send family members to school, or to avoid and emergency, creates capital of all kinds. Other members of the local community can benefit from opportunities created by this capital by creating complementary businesses or enjoying the benefits of living in a more educated, healthier, financially secure community.

The other side of financial inclusion is that someone is making a profit by providing those loans or financial services. Typically, those people are bankers and wealthy accredited

investors. On the other hand, the people who are making money by offering loans might be from the same community and class as those receiving the loans. This is known as peer-to-peer (P2P) lending. This intra-community lending gives community members the opportunity to grow their wealth and keep it within their community. These institutions provide their community with self-directed development from within.

Informal P2P lending takes the form of "informal loan clubs," "savings circles" or "savings and credit associations." These community-based forms lending institutions pool resources among people who personally know each other and give out loans. In academic literature, these are sometimes called "savings and credit associations." These kinds of communal institutions have long histories among many cultures. They are known as "chamas" in Swahili-speaking East Africa, "ekub" in Ethiopia, "ayuuto" in Somalia, "hagbad" in Somaliland, "stokvel" in South Africa, "djanggi" in Cameroon, "susu" in West Africa and the Caribbean, "partnerhand" in the West Indies, "cundinas" in Mexico, "tandas" in broader Latin America, "cuchubál" in Guatemala and El Salvador, "juntas" or "quinella" in Peru, "pandeiros" in Brazil, "paluwagan" in the Philippines, "arisan" in Indonesia, "tanomoshiko" in Japan, "kye" in South Korea, "hui" among Chinese communities, "dhukuti" (or "dhikuti") in Nepal, "chit funds" in India, and "Gam'eya" in the Middle East (Bouman 1995). This is only a small sample of the various names that similar institutions are known by among the cultures of Asia, Africa, Latin America, the Caribbean and the Pacific Islands, as well as among their diaspora communities. In the United States, for instance, immigrants hold $30 billion in rotating saving groups (Griffith 2019).

Research conducted by Tigo Paare, a digital paare (savings group) application created by the Tigo telecom company in Chad, found that informal savings groups can serve many different social needs. For example, they can be:

> "Groups of traders in a market to who save together daily, deal with market challenges, authorities, or
>
> [groups] of producers such as farmers, or animal herders who interact as a group with their traders or commodity company, or
>
> Mobile Money dealers, and FMCG [fast-moving consumer goods] retailers who pool resources to deal with market conditions, or
>
> Diaspora people and migrants who pool resources to build healthcare care facilities or schools back home, or
>
> Church members trying to educate their children from a specific perspective or
>
> Housewives, looking at accessible opportunities to generate their own revenues."

These groups are important not only for their ability to pool resources to reach common objective, but also for the sense of community and social cohesion that they create. These groups have a "unique understanding of population needs and constraints in a way no external market research can manufacture" (Kioneki 2019).

Larger and more impersonal, formalized savings and credit cooperatives have a history in Western countries as well as around the world. "Credit unions" provide credit at competitive rates. "Cooperative banks" provide retail and commercial banking. "Thrift" or "savings and loan" associations focusing on consumer and housing loans. "Mutual savings banks" make

investments and are chartered by a government. “Rokin” or “Labor Banks” in Japan work closely with labor unions.

In many ways, peer-to-peer lending is a way for people to access credit outside of discriminatory financial institutions. These banks, investment funds, and other formal institutions often require formal credit histories, government identification, and formal property rights that act as collateral. These kinds of formal documents are necessary in institutions composed of strangers, making loans to strangers, where nobody really knows or trusts each other. The documents act as assurances from a government that a person is who they say they are, and that if they break their promises, the government will be responsible for holding them accountable. The problem with this model, as discussed before, is that people do not have equal access to large, impersonal government institutions, to birth certificates and other documents, and to the money necessary for processing fees or the costs of filing paperwork. On top of these barriers, acquiring official guarantees of your identity as a responsible lender requires prohibitive amounts of time, knowledge, and luck for many people.

Online P2P lending networks have attempted to decentralize this process by using the data held by social networks and online activity to determine if a borrower is a good candidate to receive a loan. Although this opens the market beyond those who have bank accounts and good credit scores, there are still problems with this model. To begin with, not everybody has an active online presence. The algorithms that determine “credit-worthiness” from online data can only approximate a guess at how borrowers will behave. These algorithms can also be tricked by people who manipulate their online information. The largest problem is probably the question of internet access over a feature phone, smartphone or computer.

What sets informal loan clubs apart is that they rely on the already existing social connections between family, friends, and neighbors to keep lenders honest. In the case of Kenyan chamas, two members of the group often need to vouch for a new member. The members of a chama know and trust each other.

Loans provided from community savings can grow local businesses that help a community flourish. The returns on these loans go back to same community. The local community has a chance to grow and develop by relying on their own resources. Capital in the form of loans need not be distributed only according to where it sees the most profit. Since those approving loans are members of one community, they can incorporate factors like communal well-being and economic externalities into their decisions. The people in a loan club see the effects of the loans benefit their own community, instead of financial profits being taken away to develop the financial district of a distant city.

Although informal loan clubs are superior to formal financial institutions in several ways, they have limitations on their size. These informal groups are technically small-scale capital markets, which face extreme limits of scale. The supply of capital comes from the savings of the members of the club, while the demand for capital from among that same group of members. These groups require every member to trust that their group is working well and that everyone is being honest with each other.

Once informal loan club members are using mobile money, blockchain technology allows these clubs to securely and privately record information about the identities of the members and who vouched for them, along with putting the club's accounting into a single ledger that anyone in the club can see. This technology has the potential to allow informal loan clubs which don't

personally know each other to trust one another, allowing the collective pool of loanable resources to become much larger than they could be with only face-to-face groups. This could also allow traditional financial institutions to participate. Instead of dealing with isolated individuals, these formal institutions would be making deals with an entire loan club or network of loan clubs, giving the recipients of these loans greater negotiating power.

4.1. Current state of informal associations

The World Bank reports that in "developing economies" in 2016, just under half of all adults saved money (World Bank 2017). One out six people who saved did so in informal associations (the World Bank calls them semiformal) but not formal institutions. A larger portion is likely to have saved informally and formally, but that information was not published in the report. Information on informal saving and borrowing was not collected for "high-income economies".

In informal economies, just under half of all adults in developing economies borrowed money in 2016 (World bank 2017). Less than a third of them borrowed from a formal financial institution. Even less, about 7%, borrowed from a savings club but not from a financial institution. Most borrowers borrowed from friends, family, or other sources. Information on informal borrowing was not collected for high-income economies.

Since formal saving and borrowing is useful in different cases than informal saving and borrowing, it would be reasonable to assume that a significant portion of those who save and borrow use both methods. This is particularly true for borrowing, where formal institutions may

provide larger loans, and are available at all time, while informal borrowing does not need processing time and can offer below-market interest rates.

Informal savings groups have a coordinating with one another in order to increase the pool of funds that each group can draw upon. An example can be found in the *sajcha* saving groups in the Chanthaburi province of Thailand:

> "A monk named Phra Manas Kantidrammo introduced the first *sajcha* group in 1996. By 2006, about 40,000 people out of the province's total population of 480,000 had joined *sajcha* groups associated with 121 temples. In Chanthaburi province, groups formed network organizations or federations at the district level and their activities are coordinated also at the provincial level… To augment their activities the provincial network sought to obtain additional funds… CODI [Community Organizations Development Institute, a public organization dedicated to supporting community organizations and civil groups] a 2 million baht [about $60,000 USD] grant to the network to support the welfare funds. The network distributed the grant to twenty temple-based groups… After a year, the loan was repaid to the network at an interest rate of 24 per cent" (Midgley 2011).

4.2. Survey of attempts to digitize and expand community lending

This section of the paper will describe a key example of a contemporary attempt to digitize savings circles, providing them with various benefits and allowing them to connect with one another in a decentralized, grassroots network of credit and savings. These attempts are in their early stages, and information about design and impact is so far extremely limited. Only one

example is given, because it is the only example that fits this vision and has a reasonable amount of information published about it online.

4.3.1. Chamapesa

Stage of development

Chamapesa is currently under development. The application launch and a token distribution are planned for 2019 with no exact launch date (Chamapesa Twitter 2018). A token distribution is essentially a distribution of digital shares, like an initial public offering (IPO), but tokens can potentially have more diverse functionality than shares.

Location

Chamapesa will initially "develop and test Chamapesa in Kenya first, before introducing it into other markets using localised branding" (Griffith 2019). The company has plans to eventually expand to other African and Caribbean countries. It also has eyes on the Chinese and American markets (ibid.). In America, there is a The company is based on Nairobi (Chamapesa Twitter 2019).

With the broad adoption of M-Pesa, Kenya is particularly well-suited for methods of financial inclusion that work via phones. The Chamapesa website states that 75% of Kenyan adults use M-Pesa mobile money in their daily life (Chamapesa 2019). This level of adoption suggests that many people are familiar and comfortable with digital money and mobile payments. This familiarity eliminates the barrier that potential users would face when deciding whether to trust digital money as an alternative to tangible cash.

Savings groups are very common in Kenya, where they are called chamas. Chamapesa claims that Kenya has over a million chamas (Chamapesa 2019). For a country with close to 50

million citizens, this amounts to at least one chama for every fifty people. Chamapesa also claims that collective savings account for 46% of Kenya's GDP (ibid.).

Key problems being addressed

The central set of problems that Chamapesa tries to address are error, fraud, and theft within the chama groups (Chamapesa 2019). Chamapesa has claimed that other attempts to digitize chamas have failed to gain traction because they approached the challenge in order to fulfill their own agendas, rather than focus on the incentives and needs from the perspective of the chamas (Kioneki 2019). Governance over a chama and its assets sometimes suffers from transparency problems, which has traditionally been addressed by placing control in the hands of a chama member who is trusted and known to be responsible.

The secondary problem addressed by Chamapesa is that of reliable identity information for use by financial institutions to provide access to the formal financial system. This is the same problem that all digital forms of savings groups in some ways address.

The innovation or unique solution

The Chamapesa design begins with the principle that the chama group, not the individual, is the user (Chamapesa Twitter 7 Sep 2018).

At the beginning of the company expansion, it will hire and train ambassadors to train chama groups in using the app. Chamapesa intends to approach young people, who have the technological familiarity and entrepreneurial drive to be active early adopters (Griffith 2019). Later, there will be built-in mechanisms in the app to reward user who introduce other chamas to the app. Eventually, the Chamapesa team intends to integrate the app with online P2P marketplaces through API support (ibid.).

The first key innovation by Chamapesa is its identity model, which takes the place of individuals with identity documents verified by a central government. With Chamapesa's chama-based identity model, "users will be able to vouch for each other, and to put money on each other's performance" (Griffith 2019). This information amounts to a credit score attested by the people closest to you. This is intended to allow users of the app to "monetise their own credit reports" (ibid.). This also allows users to have a trusted, digital credit score which they can share with formal financial institutions in order to utilize formal financial services.

The platform offers solutions to the problems of fraud, governance, and theft by digitizing bookkeeping. Information about the group's funds, along with other information that chamas ordinarily record on paper, is recorded in a ledger stored on chama member's phones (ibid.). This record is kept up to date on each member's phone using a small-scale blockchain called a *Ricardian Litechain*. Each chama has a unique Ricardian Litechain, keeping their data private among themselves (Won't Believe 2018). This variety of blockchain was designed to fit onto cell phones and operate over 2G cellular networks (Griffith 2019). SOX (Secured Open Transactions) technology is used to allow secure connections over networks with low bandwidth so that chamas can keep their information private, hidden even from phone service providers (ibid.). The only data stored on centralized servers are encrypted backups used for the sole purpose of identity recovery in the case of a lost or stolen phone. The use of blockchains in this context allows chamas to pool their money without vesting control over the pool in the hands of one trusted person. If not every member of the chama has a phone, then those members without will have to place their trust in the members who do have cellphones to manage the group ledger fairly. This has some potential to create an imbalance of power within the chama, although as

long as at least some of the members running the Ricardian Litechain are trustworthy, the entire Ricardian Litechain can be trusted as a group ledger. Further, chama members without cell phones have no less control over the group ledger than they would if the group uses paper ledgers. The shared blockchain-style ledger creates an even more transparent, more accountable ledger that is controlled by the chama group members with cell phones, which can be maintained on top of a traditional paper ledger if need be.

The Ricardian Litechain innovation makes operations within the chama group more accountable and transparent, but is also significantly more useful because of its digital medium. While traditionally the chama's accounts are recorded on a paper ledger that stays in one trusted location, this digital ledger contains the same information but can be instantly copied and shared at will with other chama groups across any distance. The information about the accounts of other chamas is trustworthy because the application itself stores the ledger information. Information about the members of other chamas, such as their names, addresses, and so on is trustworthy because the information stored securely by the Chamapesa application was recorded by a real, face-to-face group of people who trust one another. Members of the chama who run the application, which may be all of the members if all of them have cell phones, personally know each other on a personal basis. Beyond that, they are staking their own money and reputation on one another's success. This is the ordinary situation for non-digitized chamas. By creating a shared digital record using the same process that a shared paper record would traditionally be made, in face-to-face chama gatherings, strangers in other chamas can trust that information. The Ricardian Litechain becomes the medium that establishes trust, and allows for communication and coordination across the boundaries of distance and personal connection.

The third major innovation is Chamacoin will run using a cryptocurrency called Chamacoin. This digital currency which will be backed by cash reserves and distributed among chamas (ibid.). The app will integrate with established payments rails, whether those are M-Pesa and other forms of widely-adopted mobile money, or bank clearing systems such as the Automated Clearing House in the United States (ibid.). International markets for other currencies and cryptocurrencies, as well as for chama shares, are planned to be built into the app (ibid.). By making seamless the transition between local mobile money and international cryptocurrency, and even foreign currency, the platform allows entrepreneurs to form international business connections and reach international markets (Won't Believe 2018).

Chamacoins will be backed by assets which will be held "in small quantities by tens, hundreds, or thousands of savings groups" (ibid.). This is intended to help prevent corruption by distributing valuable assets backing the digital currency. It also creates a liquid market for assets such as cash and digital money. Chamas will be able to mint new Chamacoins by putting assets in a trust administered by a smart contract, a process which can be reversed if the chama chooses to withdraw its assets (ibid.). The team recognizes that making this process as simple as possible will drive adoption (ibid.).

The aim of the Chamapesa application is to digitize chamas with the option for multiple service providers to "plug in" (ibid.).

Use barriers

A cell phone is a basic requirement to use the Chamapesa. It is not clear what capacity feature phones and basic cell phones will have to see the benefits of the app, or whether they will be able to run it. Chamapesa has stated that the app will be available for iOS, Android, and

desktop, which suggests that much of its design, at least at the beginning, will go towards a smartphone and desktop user interface (ibid.). As mentioned earlier, the app is designed to run with low bandwidth, so ideally it will run wherever people have network service. Since Chamapesa claims that one of its design principles is that the chama is the user, it may not be necessary for every member of a chama to have a cell phone, and many of the benefits of the app may be realized even when the group owns only a single cell phone. However, the app is too early in the development phase to say exactly what barriers to use will exist.

Ownership and fee structure

Chamapesa is privately owned. Fees will be taken as a 0.5% fee on transactions (ibid.). The app will be free, so potential users feel free to "try before they buy" (ibid.). Chamapesa intends to pay about 80% of collected fees back to chamas in the form of incentives (ibid.). Given that the average amount of funds held by Kenyan chamas is $13,000, Chamapesa expects to take an average of $133 in fees annually from each chama and keep $26, or 20%, in profit. Chamas will directly own their own data (Chamapesa Twitter 7 Sep 2018).

4.3. Expanding the savings group through online connections

One of the major goals of the attempts to digitize informal savings groups is to allow them to connect to outside investors and outside investments.

4.3.1. Incentives and trust – network coordination

The members of a social savings group meet each other face-to-face during their meetings and broader social life. They come to trust one another through their personal knowledge of each other and through their shared social networks and personal relationships.

Members of the savings group can share their information, such as occupation, monthly income, credit and savings history within the savings group, name or location as needed with outside investors. Rather than this information being verified by a formal institution, it is verified by the members of the same savings group. A basic source of trustworthy information can be established if someone in possession of formal documents about their identity verifies the names and address of members of the savings group. Further information can become trustworthy when members of a savings group accept risk on behalf of each other. If a member accepts some financial responsibility in case a fellow member defaults on a loan, they are proving that the information about the borrower, which they have verified, is true. If the information wasn't true, and the borrower was less likely to repay a loan than their false information would suggest, then the verifying member of the group would prefer not to verify that information for fear of being held responsible. This works especially well if the verifying member has investments in outside groups. The dividends of these investments cannot be immediately withdrawn from the system, and they can easily transfer out of their ownership as a penalty.

Another form of trust-building collateral is when the verifying member puts some of their own money into the loan. In this case, they are still financially responsible for the success of the loan, because if the borrower fails to repay, the verifying member will not get their money back. This is how savings groups already work. The new aspect with digitization is that outside investors can now access the information about the savings group that was previously only known to the members of the group. Outside investors know that they can trust a borrower in a savings group as much as other members of that savings group trust the borrower.

In the same way as outside investors can access information about a borrowing member of a savings group, the lending members of a savings group can access information about lending members of other savings groups. This means that savings groups can lend to members of other savings groups without directly knowing the borrower. Before, a borrower in a savings group only had access to money from members of their own group. Now, a borrower potentially has access to funds from savings groups across the world. Before, a lender in a savings groups only had the opportunity to invest in business opportunities known by members of their own group. If there were no opportunities at any given time, their savings would not be put to use and would not be making interest. Now, lenders in savings groups have access to business opportunities from savings groups across the world. This should drastically increase the potential revenues and opportunities faced by savings groups.

People can access credit and earn interest on their savings using this model without having any document requirements or paying any fees besides minor fees necessary to run the trading network, which for at least one application, Chamapesa, was as low as 0.5% per transaction. This possibility opens financial access to a wide range of people that were previously excluded from the financial system.

It is not necessary for every member of a savings group to own a cell phone. In fact, for a savings group to access outside borrowers and lenders, only a single phone shared among the group would be strictly necessary. In this case, the group could lend out money to other groups just as well as any other group. On the borrowing side, these groups would function like a single borrower, spreading the risk of default among themselves.

While some savings groups would prefer to keep control over which lenders they wish to supply credit to, other savings groups may choose to automate some or even all of their lending. The more trustworthy or reliable a borrower is, the less risky it would be to let the network automatically transfer funds from savings groups to the lender, up to the lender's requested loan amount. Risk scores can be automatically calculated from the information supplied by savings group members without revealing that information to everyone in the network. In fact, none of this sensitive information must necessarily be shared, and automatically generated risk profiles can be generated by the network software and provided to savings groups in the network. On the other hand, more institutional investors can also participate in this kind of network using their own algorithms for determining risk profiles, allowing the algorithms to interact with lender information without making the information itself available. If these algorithms prove effective, the network could automatically incorporate the new, more effective algorithms and fairly compensate its provider. All of the actors and groups within the network benefit from each other's specialized knowledge.

4.3.2. Startup analytics and advice platforms

The more information about a business opportunity is available, the more lenders can trust borrowers and provide them with adequate resources to successfully seize the opportunity. In a digital peer-to-peer lending network as we have been describing, lenders can provide measurable accounts of cash-flows and other business metrics to their lenders, to prove their success and secure more funding.

An example of this type of system is BlockSeed Investments, where potential new businesses describe their business proposition and provide data about their operations to match

with investors, consultants, and experienced advisors (BlockSeed 2018). In exchange for some equity stake in the company, people with the right expertise to help the new business succeed with the help of real-time information about the business and its market. They can provide this advice remotely, and since these experts are stakeholders in the business, they have strong incentives to help it succeed. Using a similar system, digitized savings groups can access expert knowledge from across the network so that business opportunities with potential will be much more likely to succeed.

References

Bouman, F.A.J. 1995. *ROSCA: On the Origin of the Species*. Savings and Development Volume XIX, No.2, 1995, pp. 129

World Bank. 2017. *The Global Findex Database 2017.* World Bank Group.

BlockSeed. 2018. Retrieved from: https://blockseed.co/

Midgley, J. & M. Hosaka. 2011. *Grassroots Social Security in Asia.* Routledge.

5. Conclusion

This research project began with an observation about the global financial system. The problem that this research project pointed out, and which it attempted to answer, was the exclusion of vast amounts of the people of the world from accessing financial opportunities. This creates an enormous difference between the economic opportunities facing those with privileged access to the financial services and those who do not. Without access to financial opportunities, large groups of people are prevented from growing their wealth, bringing business opportunities to their communities, and managing that day-to-day financial challenges that all kinds of people face, especially those who do not have substantial income and savings.

The current state of financial inclusion shows that the share of the world's adult population which has access to financial services is low. The number of people with these opportunities and without them are roughly comparable.

The inherent limitations of current formal financial institutions, and even new attempts to spread formal financial services through mobile banking platforms, is a problem with the media

which these institutions use to store and process information. These forms of media include official documents, bills, and identification cards. For various economic and social reasons, many people find it impractical, impossible, or not worth it to acquire these documents and supply them to the formal institution. Mobile banking has the additional barrier of cell phone ownership being necessary, while formal institutions like banks require additional fees and documents as well as face-to-face meetings in a designated, centralized, and fixed location.

Although mobile banking has numerous advantages of accessibility over formal institutions, there are numerous barriers that people face in using them, only one of which is the cost of purchasing a cell phone. These barriers can be addressed with care and innovation, but it is clear that at the present time, requiring an individual to own and operate a phone in order to access financial services is by no means inclusive except in comparison to formal banking institutions.

The potential solution which this research has explored is to bring new technology to the well-established tradition of informal, communal financial groups that are common across cultures of the "developing" world and immigrant diasporas. These are shown to be genuinely inclusive to all, even those who may require credit but have no savings of their own. The strength and the limitation of these groups is due to how they mediate information about the accounts and personal information about their members. This information is personally known by members of the groups but not formally documents. Trust in this information is established through direct social relationship and social networks. The potential to bring full-fledged financial services to members of these groups comes from connecting them and formal institutions together by digitally recording the information that would otherwise simply be

known by members of the groups. As long as at least one member of the group has even a basic cell phone and service, they can borrow from and lend to members of other informal groups, not just within their own. Where each informal group is typically self-contained, by using a cell phone, they can connect to one another and join together into what amounts to a massive, decentralized bank.

This option for financial inclusion seems vastly superior to attempts at expanding formal services for more reasons than simply being more accessible. Since the borrowers and lenders are both members of informal financial groups together, the profits made by either party stay within their group, their community, or people in similar communities. The people who take out loans one day are the same people who might be offering credit and earning interest another day. The rules of this system are written by ordinary people in informal financial groups, and those can be absolutely anyone as long there is anybody in their life who personally knows and trusts them.