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Can Blockchain Accelerate Financial Inclusion?

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September 7, 2020

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Master Thesis

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Abstract

Blockchain technologies have been under the spotlight in the financial inclusion industry. Many researchers believe that the low-cost, decentralized digital solutions could be the next silver bullet in order to reach out the 1.7 billion individuals leaving in poverty and being excluded from any formal financial services. Microfinance has been suffering from its structural flaws since the late 2000's raising questions about its feasibility and effectiveness as a tool to alleviate poverty and for economic development. The mean of this thesis would be to analyse the disruptive effects that could be brought by Blockchain Technologies and to analyse whether they could act as a correction mechanisms and tackle structural flaws present in the microfinance industry. The Thesis would be structured in four main parts, analysing first the financial inclusion and microfinance industries, the Blockchain ecosystem, a Blockchain-powered company and concluding on what's next for Blockchain within the microfinance industry.

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List of abbreviations

AS	Adverse Selection
BTC	Bitcoin
BT	Blockchain Technology
BOP	Bottom of the Pyramid
DLT	Decentralized Ledger Technology
DAO	Distributed Autonomous Organizations
FI	Financial Inclusion
FS	Financial Stability
FFS	Formal Financial System
IA	Information Asymmetry
IT	Information Technology
IMF	International Monetary Fund
JLLM	Joint-Liability Lending Method
MFI	Microfinance Institutions
MH	Moral Hazard
NGO	Non-Governmental Organizations
PoW	Proof-of-Work
SHG	Self-Help Groups
tps	Transaction Per Seconds
UN	United Nations
UNDP	United Nations Development Program

1. Introduction

Microfinance has been praised as a silver bullet in economic development discourse since Dr Muhammad Yunus was awarded the Nobel Peace Prize in 2006 for his efforts to improve the lives of the poorest of the poor through the provision of micro-credit. Despite the rapid growth of the number of microfinance institutions (MFIs) since the 2000's, micro-credits can be traced to the 1970s, when national governments started to provide loans to farmers or micro-entrepreneurs. Nevertheless, the use of micro-credit as a mean to help people getting out of poverty was indeed initiated by Dr Yunus with the creation of the Grameen Bank and the provision of loans to poor entrepreneurs in Bangladesh. The social and financial success that Grameen Bank experienced after its foundation rapidly caught the attention of NGOs and national governments, who ultimately replicated Yunus' model across the developing world.

With the proliferation of such financial institutions around the globe, the model has been modified and adapted, which has ultimately generated a range of both positive and negative outcomes, raising questions about the feasibility and effectiveness of micro-loans as a tool to alleviate poverty. Particularly, the rise of MFIs focused on profits rather than economic development through financial inclusion, has been widely lamented with a number of controversial cases leading to suicide and the aggravation of the situation in entire communities. In response to these issues, various scholars have not only sought to assess the effectiveness of microfinance as an economic development tool but have also identified its root issues. While some of these cases are exclusive to certain countries or institutions, significant structural problems are evident. Elevated operation costs, lack of financial sustainability and scalability, severe information asymmetries, and a lack of transparency and poor governance have been cited as some of the most persistent and recurrent issues in the industry. Digital and financial technologies have taken the centre stage of financial inclusion industry and have brought new hopes as a potential correction mechanism that could prove efficient and effective than traditional regulatory tools. Nevertheless, a consensus has yet to be achieved in identifying the most suitable technology for such industry.

Blockchain has emerged as a hot topic in recent years due to the rise of cryptocurrencies, which was signified by the upward bull run Bitcoin experienced in 2017. The tech sector has since looked to a multitude of possible implementations of blockchain that have the potential to disrupt almost any industry. Regardless of the hype, critics have been questioning the feasibility of these implementations; not only in regard to blockchain's capabilities but also whether it makes sense to pursue these innovations.

In assessing the potential of blockchain technologies, two fundamental aspects exclusive to the microfinance industry should be addressed:

First of all, the lack of transparency and the information asymmetries that exists between lenders and loan holders are more significant in microfinance than in traditional retail or commercial banking. Loan holders represent the lowest percentiles in terms of financial literacy and banking. Arguably, the lacking education of most beneficiaries leaves them in a vulnerable position in key areas of microfinance, such as contracts, risk, interest rates, insurance and liability. The source of such asymmetry is structural, and even when each element of a loan is fully transparent, there will always be room for ill-intended agents to take advantage. In some cases, lenders provide little or no information to beneficiaries since they are far removed from the mainstream financial sector. Hence, there are no records to verify the trustworthiness of individuals, and a large majority of income-generating activities is highly variable or seasonal (Cuellar Benavides, 2018).

Secondly, capital requirements per transaction are considerably small, while there is a sizeable number of beneficiaries to attend to. Moreover, the cost of canvassing new customers in comparison to the size of the amount lent, is drastically higher in microfinance than in regular commercial loans, leading to increased interest rates on micro-credits. Since MFIs cannot cover its costs directly from management fees, the interest payments stream needs to be maximised. Blockchain Technologies could possibly reshape the role of intermediaries, resulting in more efficient, safer transactions and ultimately lower interest rates.

2. Methodology

The purpose of this study is to determine whether Blockchain technologies could be a correction mechanism for the development of the financial inclusion industry . The Planned research framework, methods of sample selection, literature selection and the analysis of the results will be explained here. By conducting this research under an interpretation paradigm, I gained an in depth understanding of the impact that Blockchain could have on financial inclusion companies through the conduct of cases studies and interviews. The description of one Blockchain powered company would be included on the case study at the end of the thesis.

The methodology used in order to conduct this research is qualitative and the method was characterized by a direct contact between the researcher and the respondents. Before the interviews I proceeded to a literature review in order to analyse the current landscape of financial inclusion and Blockchain. After the analysis of the status quo I went through several interviews, one of which has been translated into a case study at the end of the thesis. The interviews took place via remote sessions and where based on open-ended questions, which enabled both

researcher and the respondents to develop the topics without being constrained to a precise question.

Those interviews went in complement to the theory exposed in the literature review and brought depth by adding real worlds cases. This two main pillars enabled me to draw my own conclusions on the question of Blockchain as a correction mechanism within the financial inclusion industry

3. Financial inclusion

"*No society can surely be flourishing and happy, of which by far the greater part of the numbers are poor and miserable*" - Adam Smith

Since the end of the 2nd World War, poverty eradication has been a key topic in public policy discussions. Being the first of the eight goals of the Millennium Development Goals (MDGs) set out by the United Nations Development Program (UNDP), poverty eradication has come under the spotlight of all major humanitarian organisations. Since the late 1990s, global poverty rates have been cut by more than half[1]. Nevertheless, 8% of the world's workforce still lived below the international poverty line of USD 1.90 a day in 2018[2].

Looking closer to the causes of poverty, a lack of financial inclusion (FI) in developing countries has attracted the attention of policymakers and humanitarian organisations. Following several studies in this field (Lopez & Winkler, 2018; Demirgüç-Kunt & Klapper, 2012; Allen et al., 2012; Kumar, Narain, & Rubbani, 2015; Sahay et al., 2015), financial inclusion is a prominent topic in development economics.

The World Bank has set the tone. As per Demirgüç-Kunt and Klapper (2012), around 20% of the population remains excluded from any structured financial system. This bulk of people, representing roughly 1.7 billion human beings, live in developing countries[3], where, in some regions, up to 90% of adults are defined as unbanked (Mehrotra & Yetman, 2015). The direct consequences for those individuals are broad. From not being able to make simple payment transactions to not being able to set up an insurance policy, their exclusion can have a direct impact on the economy and society.

[1] https://www.un.org/en/sections/issues-depth/poverty/
[2] ibid
[3] As Per Demirgü.-Kunt and Klapper, even in some developed economies, one out of five adults has no bank account or any other access to a structured financial sector

Financial inclusion (FI) refers to efforts to establish an inclusive financial system, where all members have access to affordable financial services. This first chapter of this thesis will be dedicated to financial inclusion. First, we will look at the literature in order to establish a definition of FI. In a second step, we will examine the importance of inclusion in society as a whole, focusing on microfinance. Finally, we will analyse the limitations of FI to assess its effectiveness in reducing poverty.

3.1 What is financial inclusion/exclusion?

Financial inclusion (or alternatively, financial exclusion) has been extensively discussed during the last decade and is seen to be englobed in the broader concepts of social inclusion or exclusion (Sarma, 2008). Looking at an early study by Leyshon and Thrift (1995), financial exclusion refers to mechanisms that create vicious circles preventing certain populations or individuals from gaining access to a structured financial system. A later study conducted by Sinclair (2001) came with the following definition: '*Financial exclusion means the inability to access necessary financial services in an appropriate form. Exclusion can come about as a result of problems with access, conditions, prices, marketing or self-exclusion in response to negative experiences or perceptions*.' Moreover, he added that financial exclusion could be defined in either a tapered or an extensive sense. In a tapered sense, it refers to the exclusion of any particular source of credit and any other financial service, while in an extensive sense, it refers to factors that prevent those most in need from gaining access to any mainstream money services (Sinclair, 2001).

Prominent international institutions have their own definition of the phenomenon. The World Bank defines FI as follows: 'Financial *inclusion means that individuals and businesses have access to useful and affordable financial products and services that meet their needs – transactions, payments, savings, credit and insurance – delivered in a responsible and sustainable way*.'

Every definition has a core message, but they seem to follow the same direction: ensuring access to appropriate financial products and services for all members of an economy. There is no universal definition of financial inclusion, but it is essential to look at several in order to understand its primary features.

As seen previously, financial inclusion is seen as part of a broader concept of social inclusion and exclusion (Sarma, 2008). Indeed, the less well-off living without access to a structured financial system could suffer from several sources of social exclusion. According to Kempton

et al. (2000), social exclusion is a wider concept that '*is a shorthand term for what can happen when people or areas suffer from a combination of linked problems such as unemployment, poor skills, low incomes, poor housing, high crime environments, bad health, poverty and family breakdown'*. To sum up, social exclusion fosters the social gap and classes, resulting in a stratified society and ultimately impacting the health of economies (Adunda & Kalunda, 2012).

As per Kempson and Whyley (1999), there are six different types of financial exclusion; that is, physical access exclusion, access exclusion, condition exclusion, price exclusion, marketing exclusion and self-exclusion. Physical access exclusion refers to the remoteness in which the less well-off live (i.e., rural areas, slums, etc.). The second type refers to the restriction of access via a process of risk assessment[4]. Condition exclusion is when the underlying conditions of a financial product (i.e., repayment terms for a loan) make it unsuitable to the needs of certain individuals. Price exclusion is straightforward; it occurs when the individual can only gain access to financial products at a price they cannot afford (e.g., high interest rates for access to credit. Marketing exclusion is when someone is simply excluded or not targeted by the sales and marketing efforts of financial institutions. Last but not least, self-exclusion refers to those that decide there is little or no benefit at all in applying for financial products and services as they foresee they would be refused by financial institutions. Taken together, these six forms of exclusion represent a set of barriers to access and use day-to-day financial products and services.

Over the past few years, efforts directed toward financial inclusion have predominantly fallen into the area of advocacy (Chibba, 2008), led by the major organisations. As suggested by Chibba (2008), tackling financial inclusion requires a particular focus on what he calls the four key pillars: private sector development, public sector support, financial literacy and microfinance. Microfinance will be the focus of this thesis due to the impact it has on the design of today's public policies on financial inclusion.

3.2 The importance of financial inclusion

While it seems that a lack of financial inclusion (or financial exclusion) encompasses other forms of social exclusion, it is essential to decrypt the mechanisms behind the possible effects financial inclusion has on the Bottom of the Pyramid (BOP).[5]

[4] The second point will be particularly important for the rest of the thesis (i.e. microfinance and blockchain)
[5] Bottom of the pyramid (BOP) has emerged as a crucial concept in modern economics, first proposed in C.K Prahalad's (2005) *The Fortune at the Bottom of the Pyramid*.

Financial inclusion is viewed as a central factor in the economy and society as a whole. The consensus seems to be that increased financial inclusion creates and generates further economic growth and, thus, reduces poverty (Park & Mercado, 2015; Yetman & Mehrotra, 2015). In this section, we will discuss the importance of financial inclusion to society to examine whether it is a catalyst for poverty reduction and financial stability.

At a macro level, the enhancement of economic growth and economic stability is fundamental. Indeed, increased financial inclusion will stimulate general economic growth (IMF, Sahay, 2017) and will impact various sectors, such as education, health, income and housing, as well as general inequality (Demirgüc & Klapper, 2013). Looking at the empirical evidence (Morgan & Pontines, 2014), increased financial inclusion could be either positive or negative for financial stability. Indeed, on the positive side, financial inclusion could enhance the diversification of bank assets, reducing their risk. Moreover, a bank's liquidity risk is greatly reduced due to the increased stability of the deposit base of assets. On the flip side, inclusion could lead to an erosion of credit standards, bank reputational risk and, last but not least, inadequate regulation of monetary financial institutions.

As seen earlier, financial inclusion is defined as the availability of a diverse range of financial products and services to all people at the BOP, normally accessible to mainly the non-rural section of the population (Negi & Sharma, 2014). It is then important to state that financial inclusion is not only about credit granting but rather encompasses the following three levels of access (Negi & Sharma, 2014): contingency planning, credit and wealth creation. Access to these mechanisms can empower the less well-off and help them stay aboard the economic development boat.

At a microeconomic level, there is growing evidence that a structured financial system has considerable benefits for the population, especially for women and poor adults (Demirgüc. Klapper, & Singer, 2017). In order to complete the model proposed by Negi and Sharma (2014), we identified four types of mainstream financial products: payment services, savings, credit and insurance. We will discuss their relative importance and the challenges they pose.

3.2.1 Payment services

Payment services can be digital, they can be cash, or they can be corn. Most people make or receive payments. On the one hand, you can receive payments for work (salary), for the sale of goods and services, or simply as a subsidy from the government. On the other hand, you can make payments when buying groceries and when you pay your bills. Since the 2000s, we

have observed an increased number of digital payments, numbers simply navigating between accounts. Those digital payments may include payment made via a credit or debit card, via the internet or via a mobile phone. However, in developing countries, many payments are still made in cash. In the following paragraph, we will discuss the existing evidence that suggests shifting payments from cash into accounts has several benefits for both senders and receivers (Demirgüc, Klapper, & Singer, 2017).

The empirical evidence is undeniable: Accounts can drastically improve the efficiency and convenience of payments. How? By decreasing their execution cost (making and/or receiving payments) and by greatly increasing their speed. A study conducted in Niger (Aker et al., 2013) revealed that the mobile transfer of social benefits could reduce administrative costs by 20% when compared to simple cash payments.

In comparison to cash payments, digital payments are instantaneous. This increased speed becomes increasingly important in emergency situations[6]. The digitalisation of payments comes with other advantages. Shifting cash payments toward accounts could have a significant impact on the security of payments. Indeed, with increased transparency, the account owner will be able to ensure that they receive their payment in full[7] as digital payments make it easier to track your actions.

Being able to track every transaction will help create a payment data history, opening up access to credit. Indeed, with a better risk assessment (remember here '*Access exclusion*'), lenders will be able to measure the credit risk of potential borrowers (based on credit risk). For example, it could help financial institutions better assess their credit risk and, as a consequence, minimise their non-performing loans. Arguably, this could lead to a new form of exclusion, as many low-income adults may not have any credit history, which may reduce their ability to secure a loan. However, being able to set up a data history could address information asymmetry, a fundamental problem that characterises credit markets (World Bank, 2019).

3.2.2 Saving products and wealth creation

The 'homo oeconomicus' saves in expectation of future expenses, such as large acquisitions, investments (schooling or business) and retirement. As of today, the most common form of

[6] During the Ebola breakout, the Liberian government was able to quickly pay its workers by opening accounts for them and making digital payments

[7] Here, the point is that with cash payments you might face more intermediaries, and the more steps you have to take, the more likely you will lose part of the money with each 'middleman'.

savings in developed countries is through mainstream financial institutions (banking, insurance contracts, etc.), while in developing countries, it remains more informal. It could in the form of 'saving clubs', via an individual outside the family, or just 'under the mattress' in the form of jewellery, livestock or anything valuable (Demirgüc, Klapper, & Singer, 2017).

Having a safe account at a financial institution can have some benefits. Indeed, saving your money at a bank rather than keeping it in cash at home could protect it from theft[8]. Having it safely stored at the bank could also prevent people from burning their cash and, thus, encouraging better 'self-wealth management'.

Several studies (Karlan et al., 2014; Dupas & Robinson, 2013; Brune et al., 2016) show that that savings accounts help their owners significantly decrease their private expenditure and increase business investment (Dupas & Robinson, 2013). It can be difficult to clearly identify the mechanisms, but some speculate that with limited accessibility (money is not immediately accessible), individuals refrain from compulsively spending and save for purposes that matter.

Although there is mixed evidence of the benefits of saving accounts, it seems that it helps the owner to better manage their wealth and plan their expenses and investments.

3.3.3 Credit and insurance

Most human beings borrow. It could be for buying a flat or a house, starting a business, or schooling. Borrowing is part of our way of life. In developed economies, financial institutions are reported as the main source of new loans, whereas in developing countries, individuals tend to borrow from their family and friends.

A structured financial system and, thus, access to financial institutions for borrowing can have several benefits. We identified the main advantages: On the one hand, borrowing from a financial institution could enlarge the spectrum of available funds and provide sufficient funds to invest in schooling or business opportunities. On the other, by borrowing from a financial institution, individuals might gain access to better credit agreements than they could with an 'informal' lender (Demirgüc, Klapper, & Singer, 2017).

Insurance is all about risk shifting, and relative products could act as a shield to unexpected expenses, such as those resulting from crop failure, natural disasters or even illness (Karlan

& Morduch, 2010). Indeed, insurance products offer 'risk pooling' over a much larger share of the population, which could give individuals more extensive coverage than if they relied only on their savings, credit, family or community.

3.3 How does financial inclusion reduce poverty and inequality?

Answering this seemingly simple question remains difficult. Why? Mostly because there is no standard definition, and it becomes difficult to measure the impact of a concept without a universally accepted definition. Beck et al. (2009) stated that a well-structured financial system, accessible to all, could greatly reduce information and transaction costs, financially educate individuals (regarding savings for example) and influence long-run growth rates.

In its 2008 report, "*Finance for All? Policies and pitfalls in expanding access*", the World Bank suggested that more having structured financial systems tended to reduce poverty and inequality in the long run. Here, it is essential to understand the connection between financial inclusion and a reduction in poverty and inequality might stem from the indirect effects of financial development and not necessarily from the integration of the 'excluded' into the financial system. Then, in order to evaluate the impact of financial inclusion on the reduction of inequality and poverty, two levels of evaluation are necessary. On the one hand, one should analyse the effects on the micro-level; that is, the effects that financial inclusion has directly on households and excluded communities. On the other hand, the underlying dynamics of the economy as a whole (macro-level) should be analysed.

Research conducted by the World Bank (2008) highlighted that financial development empowers economic growth and narrows the income inequalities between the different population layers. Another study conducted by the World Bank (Beck, Demirgüç-Kunt, & Levine, 2007) demonstrated a positive relationship between inclusion[9] and the variation in the share of the lowest layer in total national expendable income. Therefore, a well-structured financial system could not only boost economic growth but also increase the lowest layer's income share.

Although one could observe a vicious circle of financial inclusion (i.e., the exacerbation of inequalities with access selection for credit), several cross-country studies showed that financial depth and increased access to credit were factors in economic growth while decreasing inequality and poverty.

[9] In this case, it was represented by the ratio of private credit to gross domestic product

3.4 Two steps forward and one step back: Advancements and setbacks

Over the last 30 years, several milestones have been reached in financial inclusion on a global scale. The unbanked population dropped by 20% (Demirgüç-Kunt et al., 2015), sitting at the 2 billion mark during the period of 2011-2014 (Lopez & Winkler, 2018). In reducing the unbanked population by an additional one billion adults, the World Bank estimated that the direct and indirect effects from financial inclusion policies reached over 500 million people around the world.

The economic possibilities for the bottom of the pyramid cannot be ignored and have come to financial institutions' attention. Moreover, to answer to the BOP's financing and savings needs, new organisations, such as microfinance institutions (MFIs), have emerged by working on new types of services, micro-insurances and micro-credit policies and by setting-up new systems, such as mobile banking and payments, self-help groups[10] (SHG) and deposit collectors. Notwithstanding the impact financial inclusion has had on financial development, a lot remains to be done. One of the key success factors is flexibility in policy and regulation as their respective rigidity could hinder the development of financial market depth. However, the trend does not seem to be decelerating, mostly driven by the use of microfinance and the continual integration of new technologies that provide solutions to the ongoing challenges imposed by the current environment.

Even though the overall feeling remains positive, the question of whether financial inclusion could cannibalise financial stability remains. Indeed, as per Adunda and Kalunda (2012), financial inclusion will require specific rules for a specific market constitution. The objectives of financial stability must then be considered by policymakers in an attempt to set-up a sustainable development path that could overcome the numerous economic shocks that usually affect the less well-off the most.

Indeed, as shown by Garcia (2016), some of the more aggressive responses to the 2008 crisis toward financial inclusion could have an undesirable impact and could ultimately lead to tensions between achieving financial stability and ensuring greater inclusion for the population. As a matter of fact, financial stability can be defined as a market condition, where the financial system is able to resist exogenous shocks without spilling away any cumulative advancements, which ultimately '*impair the allocation of savings to investment opportunities and the processing of payments in the economy*' (Garcia, 2016).

[10] Kumar, 2018, https://www.thehindubusinessline.com/money-and-banking/Financial-inclusion-can-be-better-achieved-through-self-help-groups-Nabard/article20678226.ece

The hypothetical risks to financial stability stem from the singularity of the low-income population, the local financial institutions, the development path of innovation in financial services and the outsourcing of functions (Garcia, 2016). Indeed, the participation of the less well-off in a structured financial system could lead to high information and transactions costs, which eventually lead to inefficiencies that give policy-makers headaches. Moreover, the effects of information asymmetry could deepen. Other factors, such as geographic concentration, a regulatory no man's land and inter-institutional lending, could endanger local institutions and make them vulnerable to endogenous and exogenous shocks.

One of the main challenges is the expansion of financial inclusion in rural and remote areas. Indeed, as of today, the expansion has mostly taken place in urban areas (Allen et al., 2012), and rural areas have been marginalised. This could be explained by several factors. First of all, it can be tougher to become and stay financially sustainable when serving rural clients. There is evidence that microfinance institutions focusing on rural populations are struggling to leverage economies of scale and productivity effects when compared with urban-oriented microfinance institutions. As per Lopez and Winkler, this phenomenon is mostly due to higher operational costs and risks and a less favourable credit environment.

Overall, the empirical evidence remains scarce when analysing the potential negative impacts of financial inclusion on financial stability. On a different note, the existing literature (Allen et al., 2012; Beck & Brown, 2011) would suggest that financial inclusion, indeed, boosts the GDP growth rate, but it does not necessarily reduce poverty.

Finally, while it seems that addressing market failure is more effective, financial inclusion efforts are mostly oriented toward an increase in financial access (i.e., branch expansion). Indeed, as per Garcia (2016), it should be more useful to increase policies that aim for a supply expansion (i.e., diminishing market failures such as information and transactions costs) rather than working on the surface of the problem by simply reducing selection and monitoring criteria that could have undesired effects on financial stability.

4. Funding at the bottom of the pyramid: A word about microfinance

'*This is not charity. This is business: business with a social objective, which is to help people get out of poverty*' - Muhammad Yunus

Tackling the issue of poverty by ensuring financial inclusion, especially by providing micro-loans to those excluded from the system, is an idea that emerged in the late 1970s. Muhammad Yunus, laureate of the 2006 Peace Nobel Prize, founded the Grameen Bank of Bangladesh and its underlying model, the Social Banking Model (SBM). Ever since, this model, and more precisely microfinance, has become the primary vehicle to include less well-off groups in the financial system of the developing world.

Microfinance was first conceived as a way to boost the productive capacities of the poor dependent on self-employment (Hulme & Mosley, 1996). The goal was clear: micro-loans would transform individuals' businesses by providing them with capital, boosting their earnings and, ultimately, eradicating poverty (Yunus, 2016). Microfinance has been applauded for its innovation of credit contracts, especially lending and instalment lending (Ghatak & Guinnane, 1999). As per Conning and Morduch (2011), microfinance forges new standards of development, standards that knock out governments as central actors and turn their attention to establishing market mechanisms to deliver a wide range of services through financial institutions that work towards achieving social and financial goals.

It is crucial to delve deeper into the underlying mechanisms of microfinance to be able to draw solutions for its challenges and plan for its expansion. For some researchers, the term microfinance was summed up as the granting of micro-loans (Adunda & Kalunda, 2012) to small firms and micro-entrepreneurs without considering institutional banking and group-based models (Rachmawati, 2017). However, today, the idea has evolved. No longer solely an alternative financing solution for the excluded from the BOP, microfinance has transformed into a tool for social ascension and escaping poverty.

The empirical evidence (Yunnus, 2016; Karlan & Zinnan, 2007; Cotler & Woodruf, 2008) tends to show that microfinance reduces poverty but, as observed by Mossman (2015), many researchers see microfinance as a useful tool for the integration of financial services but not for transformative intervention. Indeed, critiques have been directed towards the methodologies used by microfinance institutions and the replicability of the observed results

(i.e., region or country-specific). Despite high expectations, some stakeholders have deemed microfinance a fad craze, ‘a neoliberal contrivance that entranced donors but failed to deliver services that truly helped poor communities’ (Bateman & Chang, 2012). According to Hulme and Maitrot (2014), the profitability of lenders has overtaken the poverty of customers as the main focus.

As per Cull and Morduch (2017), claims about microfinance’s impact and underlying profits have been largely exaggerated, but so have claims about failures. Indeed, it seems that there are mixed results in terms of both impacts and profits. Overall, microfinance has proven a robust tool that ultimately provides a path to financial services for certain groups living in extreme poverty; an extended panel of products and services adapted to the poor. As a matter of fact, microfinance has, since its debut, worked to reduce (or close) the gap between incumbent financial institutions and the less well-off by setting up intermediary tools that help centralise transactions and reduce underlying costs (i.e., transaction costs) (Siriam, 2005). The establishment of loans and micro-loans has enabled the set-up of saving accounts, financial literacy, insurance and credit records in under-served communities. This enlarged landscape should also broaden our vision of microfinance. Microfinance is not only about stimulating small businesses. Instead, microfinance should be considered a funnel linking and directing available money to households in need, a financial liquidity enhancer. In this view, microfinance supports households in answering to the ups and downs of living in extreme poverty, even when the latter persists (Collins et al., 2009).
With the evolution of the microfinance movement, financial institutions have taken advantage of the anchoring and competence of MFIs to develop a portfolio of products and services designed for the BOP. For example, insurance products (life or health insurances) for the poor have been flourishing and are increasingly offered by financial institutions and non-governmental organisations (NGOs) (World Bank, 2018). For these to be monetarily feasible for the commercial issuer, it was important to discover a conveyance channel that had the trust of target clients. Normally, MFIs, NGOs and saving cooperatives are the most reasonable vehicles to connect the two.

Most of the world’s less well-off are facing substantial risk, which will impact their investment decisions and, ultimately, perpetuate poverty (Karlan et al., 2013). In this environment, insurance products become increasingly appealing as new vehicles to both make a profit and improve social welfare (Banerje et al., 2014). The arguments for insurance products in the case of microfinance seem straightforward. Mixing insurance policies with other products, such as microfinance loans, is seen as a promising solution to increase demand (demand for insurance products is usually low in this context) and address the adverse selection problem.

Here, choosing insurance products in the arrangement of microfinance seems intuitive. Indeed, there is a gap that can be filled efficiently by microfinance institutions, and, most importantly, there is a good economic incentive for them to do so. MFIs could either serve as the agent to a larger insurance company or offer the insurance product themselves directly. Ultimately, by providing protection to the contractor, they end up protecting themselves (Banerje et al., 2014).

Another service that will be relevant later on in this thesis is the transfer of international remittances, which have become one of the main sources of income in developing countries. Being usually subject to high fees (i.e., high transaction costs), these types of transfers will mostly follow informal remittance channels. They have been typically bundled with microfinance institutions' offerings, leveraging their geographical outreach and the trust built with local populations in rural areas.

Overall, what we have seen is that what MFIs offer extends far beyond loans and credit. Even more interesting, the research 'Finance For All?' conducted by the World Bank (2008) highlighted that MFIs bundling other financial services with their credit offering achieve not only better repayment performance overall but also better client retention statistics than institutions only specialised in credit. On the other side of the spectrum, the customers of such providers also experienced increased business performance when compared to those that opted for credit only.

4.1 The evolution of microfinance

The origins of microfinance are still open to discussion. It might have taken root with the 19th-century credit cooperatives (Banerjnee et al., 1994), while other researchers argue it began with informal financial mechanisms like rotating credit and savings institutions (Rutherford, 2009). The 1970s mark a turning point in the fight against poverty, considering poverty instead as a structural problem that could be addressed by the inclusion of the poor.

Between the 1950s and 1970s, financial institutions and governments mostly focused on providing micro-loans to small and marginal farmers to boost productivity and incomes. During that period, however, international donors and financial institutions increased their efforts to expand access to agricultural credit that ultimately led to government interventions with targeted loans made via state-owned financial institutions, or sometimes via farmers' cooperatives, often leading to favourable repayment conditions (i.e., below-market interest rates). As a result, rural development banks were exposed and suffered significant erosion of

their capital as a consequence of subsidised loans mixed with very low repayment rates. This scheme eventually led to an increase in corruption and credit default rates (Kringlen, 2016).

4.1.1 Muhammad Yunus and the Grameen Bank

The start of the microfinance movement is still debated, but 'modern' microfinance as we know it today is usually associated with the Nobel Peace Prize Laureate Muhammad Yunus. In the mid-1970s, Yunus started to conduct early-stage microcredit experiments by first extending small credits to female beneficiaries after a visit to a small village in India. Indeed, with the limited opportunities for employment for women in undeveloped countries, entrepreneurial initiatives became a new vehicle to tap into the economic potential of women during the 1980s (Premchander, 2009). As a result, women became the primary target group of microfinance programs during this period (Premchander, 2009).

After his experiments in India, Muhammad Yunus observed that, relative to their size, small loans had an impressive underlying impact on these groups of individuals, which led him to start a new movement to improve their lives. Muhammad Yunus first created an alliance with Janata Bank to provide loans to the residents of Jobra. In the 1980s, he founded the Grameen Bank with the sole purpose of providing financial services to the poor.

The focus of these new mechanisms was simple: match the less well-off's demand for credit and other financial products with the repayment methods of financial institutions. The Grameen Bank successfully changed conventional banking practices by simply removing the classical 'collaterals' systems and created new mechanisms based on mutual trust, accountability, participation and creativity (Polacapital, 2017[11]). These informal practices produced remarkable results, where more conventional banking practices had failed over and over again (Armendàriz & Morduch, 2010).

One innovation that radically changed the landscape was basing credit on group liability rather than on individuals. Indeed, the Joint-Liability Lending Method (JLLM) was used in the Grameen Bank Model to reduce not only the risk of default but also the risk of moral hazard. With this model, microfinance institutions are able to provide credits to groups of customers that ultimately share responsibility for repayment. This mechanism creates a virtuous circle as the borrowers receive the right incentive to monitor each other, reducing the default risk (Burton, 2011)[12]. Moreover, this new lending mechanism greatly reduces not only operational

[11] https://polacapital.com/2017/08/22/models-of-microfinance-interventions-the-grameen-bank-model/
[12] An evolution away from joint-liability lending in microfinance

and transactional costs but also information asymmetry (Burton, 2011). Surprisingly, these new lending methods showed encouraging results, with credit default rates way below the averages of traditional lending institutions (Chae et al., 2012), showing that the very bottom of the pyramid could also be creditworthy.

4.1.2 The commercialisation of microfinance

Since the late 1970s, microfinance has been predominantly governed by non-for-profit organisations that aim to provide small and micro-loans, financial literacy and other financial products and services to people living in poverty. These institutions are motivated by their mission, the scope of their actions (population reached, the sustainability of their programs, financial viability) and the impact they have on local populations. However, the commercialisation of microfinance has changed the landscape.

In the early 1980s, the Grameen Bank Model was already engraved in microfinance and loans, and under the JLLM, they were mostly group-based. Microfinance's exponential success eventually led to its first setback, its need for financial sustainability. As a response, microfinance institutions started to look more closely at their profits and costs, leading them to take a more minimalist approach[13]. The solution was to merge the microfinance sector with the commercial banking sector.

The commercialisation of microfinance and its impact on social returns and the outreach of MFIs has been widely discussed. Indeed, the historical mission of MFIs reached new heights to cover different sorts of financial services to provide to the poor. As an example, in some African and Latin American countries, MFIs started to have multiple caps, receiving bank licenses to be able to collect deposits from customers. These connections between banks and MFIs created a virtuous circle where banks were able to fund MFIs while keeping their focus on lending to low-income individuals (World Bank, 2008).

As of today, microfinance does not limit itself to providing micro-loans. As seen previously, a large panel of additional services has been bundled into MFIs' portfolios. From savings accounts to insurance products and remittance services, the microfinance sector has experienced exceptional growth since the late 1970s, with the average loan portfolio growing by between 40% and 60% (Kringlen, 2016).

[13] As per Premchander (2009), they focused more on the provision of services that could cover their operational costs

Although it seems that there is a general consensus that the commercialisation of microfinance is necessary to maximise the outreach of the microfinance industry (Vering, 2012)[14], the last decades have been said to result in a 'mission drift' from serving the poor.

4.2 Challenges and deficiencies

The microfinance industry has seen rapid expansion, and with its commercialisation, claims about its mission started to emerge. Indeed, people started arguing that the industry was abandoning its mission to serve the poor (Dichter & Harper, 2017). Thirty years of dedicated and unrelenting effort, and there are still billions of poor in the world. Microfinance has been lauded by many to be the oracle to fight and end poverty. While it seems that the combat is still on, some implementation cases generated little to no impact, and even more disturbing, had negative outcomes. The question arising then is whether those cases should be considered isolated or whether the long-term effects of microfinance might have been overestimated.

Financial inclusion has been praised as the silver bullet to fight poverty, and, indeed, there is empirical evidence that it effectively stimulates GDP growth. But despite positive results, it does not necessarily directly help those in poverty. In its early debut, there was much hope that microfinance would transform economic and social structures and drastically bring change at the household level in developing countries. Today, the microfinance market is estimated to be worth around 60 to 100 billion USD, with over 200 million clients around the world, but the outputs have been ambivalent[15]. More and more, critics point out the modest benefits associated with micro-loans, along with over-indebtedness and a drift from microfinance's ultimate mission to serve the poor.

Critics have also pointed to high interest rates. Indeed, by making smaller loans, lenders will incur high operational costs and will then, in turn, apply higher interest rates to the micro-loans. As a result, poor borrowers pay interest rates that are substantially higher than those paid by richer borrowers at regular banks, which is incongruent with MFIs' claim to help the poor. The question could then be is it not better to operate sustainably rather than accrue substantial losses that could require excessive subsidies? The initial microfinance movement was based on the postulation that the poor could indeed pay high interest rates as the loaned funds were

[14] Commercialisation of Microfinance: Are International Investors Crowding Out or Complementing Local Funding of Microfinance Institutions?
[15] https://www.worldbank.org/en/news/feature/2015/03/30/does-microfinance-still-hold-promise-for-reaching-the-poor

usually used for entrepreneurial projects that could potentially yield a high return on investment (World Bank, 2008). MFIs charging rates ranging from 50% to 100% suggests lending to the poor is costly (relative to the size of the loans) and risky.

Surprisingly, empirical evidence shows that the less well-off population is willing to accept MFIs' high interest rates due to a lack of other credit and financing options and because other informal channels tend to be more expensive (Dhaka et al., 2007). As a result, the poor's demand for loans tends to be inelastic relative to any changes in interest rates; that is, their demand for loans will not be affected by any variation in interest rates.

In summary, we can see that there is a clear relationship between the operational costs of MFIs and the interest rates applied to loans. Nevertheless, while the cost of funding MFIs differs from that of conventional financial institutions, their operational costs still offer room for new development opportunities as the context MFIs operate in allow them to apply honest interest rates.

4.2.1 Operational Costs

As pointed out by Muhammad Yunus, microfinance is not about philanthropy or pure charity but should be considered a business, a business with social and financial objectives. Profitability and sustainability, therefore, remain important matters. When speaking about profits, the first inevitable challenge is operational costs. As per Islam (2011)[16], micro-lenders are confronted with two main kinds of operational costs: personnel and administrative costs. Microfinance, as a service, is highly labour-intensive, resulting in high personnel costs, while administrative costs consist mainly of rent, utility expenses and amortisation of fixed assets.

As per the Cost per Available Seat-Kilometre for short-haul flights, micro-lending is costly on a per-unit basis. Indeed, the repayment of loans is usually made by field staff, visiting the borrowers directly, adding time and travel costs. Furthermore, quasi-non-existent infrastructure (i.e., poor traffic connections, inadequate telecommunication systems) and a low population density drastically increase the operational costs of microfinance. Moreover, the structural and social exclusion borrowers face could have an impact on overall costs (operational, funding, information, transaction and monitoring).

[16] Cost Structure and Financial Sustainability of Microfinance Institutions: The Potential Effects of Interest Rate Cap in Bangladesh

The main challenges of MFIs are arguably these increased operational costs and low profit margins. Indeed, as per Mersland and Strom (2012), the variation in MFIs' interest rates and, ultimately, profitability is the result of 'increased input prices'. Mersland and Strom (2013) later supported their conclusion with evidence to show that the microfinance industry suffers from low profit margins.

As explained previously, MFIs face increased per-unit costs due to the small size of their loans. Many of these institutions will rely on subsidies or donations. Let us quickly analyse the following case: Assuming a cost of capital of 10% and a unitary transaction fee of 3% for a loan of USD 1000. In order to break even, the minimum interest should be at least USD 100 (cost of capital) plus the unitary transaction fee of USD 50, for a total of USD 150, ensuring repayment of USD 1150. Then, to only cover the cost, the lender should charge at least 15%. In the case of a smaller micro-loan of USD 50, the transaction fee would remain the same, and the interest would be USD 5, totalling a USD 10 cost burden. Then, to break even, interest of at least USD 10 should be charged, representing 20% to only cover the costs.

In their book *The Cost Structure of Microfinance Institutions in Eastern Europe and Central Asia*, Hartarska et al. (2006) observed that operational expenses tend to decrease when the number of borrowers per staff increases. This could be due to the fact that this metric is an indicator of the productivity of MFIs and that the increased number of borrowers per employee ultimately decreases the operational cost per borrower. From the above, we could then foresee that in order to reduce operational expenses, MFIs could either keep their field staff constant or increase their number of active customers.

We can now affirm that the unitary cost is high as transactions fees remain constant regardless of the size of the loan. Some empirical evidence (Lascelles & Mendelson, 2008; Hermes et al., 2011) points to an increased loan size improving operational efficiency, as for the same amount lent, field staff would have fewer borrowers to keep an eye on, decreasing the monitoring cost per loan. This idea supports that discussed earlier, adding that the operational cost could be reduced by also increasing the loan size, diffusing the different underlying costs and ultimately reducing the unitary cost per loan.

In order to reduce credit risk, one could argue the more frequent the encashment (or debt collection), the safer it is for the lender. However, a more frequent collection could, in turn, increase the costs of field staff, driving up transaction costs.

As seen earlier, the microfinance industry is characterised by low profit margins, and even if it is operating sustainably, it might generate losses that would require infusions of subsidies. In today's industry, there is still no consensus on the necessity and timing of long-term subsidies to help MFIs reach all their groups of clients. Indeed, as per Gaudill et al. (2013), it seems that subsidies lead to a substantial cost structure, led by the assumption there is a negative influence on the incentive to operate efficiently.

One might then understand better why the poorest of the world are charged with the highest interest rates. Indeed, to become and remain sustainable, MFIs will have to find a way to shift their risk and operational costs to a third party, and in order to counter their high operational costs, they will ultimately charge higher interest rates on their loans. Providing micro-loans at a reasonable rate then becomes the main challenge in modern microfinance.

4.2.2 Financial sustainability and reaching the poorest of the poor

Reflecting on the previous chapter, it becomes apparent that there is a clear trade-off between financial sustainability and the capacity of the MFIs to reach the poorest of the poor. As Don Valentine, the father of venture capital investment, states, '*All companies that go out of business do so for the same reason – they run out of money*', and it is the same for MFIs. Indeed, if an MFI fails to structure its costs efficiently, it could endanger its available loan funds, which, in turn, would mean fewer loans and, ultimately, bankruptcy (Yimga, 2018). The cost structure of MFIs is crucial to financial sustainability and scalability.

Financial sustainability and financial self-sufficiency are concepts not unique to microfinance but can be applied to numerous, if not all, profit and non-profit businesses. On the one hand, financial sustainability means ensuring the longevity of the organisation, whereas financial self-sufficiency indicates an ability to operate without any help from an outside organisation and being able to cover the entirety of costs.

As seen at the very beginning of this chapter, microfinance has gained increasing attention on a global scale, and the pressure on MFIs to become more commercially viable is growing. From this, two different approaches have emerged: financial sustainability and welfare (Robinson, 2001). The advocates of the first approach point to the importance of MFIs' sustainability through cost efficiency (i.e., reducing operational costs and managing funding costs). Ultimately, financial autonomy could enable MFIs to provide funding to poor entrepreneurs without being dependent on donors and subsidies (Morduch, 2000). The defenders of the second approach state that there is a clear trade-off between financial sustainability and serving the poorest of the poor, who might not be able to bear increased interest rates or offer enough collateral to cover the loan risk (Bhatt & Tang, 2001). The MFIs

seeking self-financial sustainability then tend to serve only the richer entrepreneurs rather than the less well-off ones.

Looking at both approaches, one could indeed ask whether there is a trade-off between sustainability and outreach, implying here that seeking financial sustainability could shift the initial scope of standard MFIs from providing loans to the poor (Nurmakhanova et al., 2014). This issue is still well-debated, and two research streams have emerged. On the one hand, the impact of outreach on the financial sustainability of MFIs has been investigated, while, on the other hand, researchers have sought to find evidence of a trade-off between self-sustainability and outreach (Hermes et al., 2011). Results seem mixed and highlight that the resulting correlation between sustainability and outreach might greatly depend on the measure of outreach used (Nurmakhanova et al., 2014). As per Lopez and Winkler (2018), it seems that MFIs that have most of their customers in rural areas demonstrate a 'deeper' outreach as the poorest of the poor usually live there.

Rural borrowers are usually characterised by the specific particularities of low population density and weak public infrastructure (Caudill et al., 2009). These particularities ultimately lead to higher operational costs, threatening the financial sustainability of MFIs. Apart from the above-mentioned characteristics, rural economies usually gravitate around agriculture and farming, which implies profits are subject to seasonality and high risk. Moreover, as per Lopez and Winkler (2018), the seasonality of agricultural and farming businesses might require more loans with extended repayment terms. The same authors argue that populations in rural areas face high information costs, leading to more frequent contract enforcements (more frequent collection, negotiation of repayments conditions, monitoring of non-performing loans, etc.) that are, in turn, harder and more costly to tackle. Briefly, it would mean that MFIs operating mainly in rural areas will face an increased trade-off between outreach and sustainability.

On the administrative side of microfinance, it has been argued that financial regulation may also create difficulties for MFIs, even shifting their target from outreach to meet certain financial requirements. While it seems there is no evidence that regulated institutions perform poorer in terms of depth of outreach (Hartaska & Nadolnyak, 2007), it seems that institutions favouring savings thresholds as a financial requirement tend to reach more borrowers. However, Cull et al. (2011) argue that profit-oriented MFIs meeting financial requirements find themselves in situations where they have to curtail their outreach to specific customers that are expensive to reach.

In brief, there is still little evidence of the trade-off between sustainability and outreach for MFIs. However, the emphasis placed on financial sustainability and the commercialisation of microfinance no doubt has implications for the outreach of MFIs. Indeed, MFIs providing individual (and usually more consequent) loans tend to return better profitability than those providing group loans but, in turn, host a smaller proportion of poor borrowers in their loan portfolios (Hermes & Lensink, 2007). Moreover, it seems that there is a negative relationship between higher interest rates and the quality of the portfolio for the individual-lending MFIs, whereas this is not the case for group-lending MFIs. With the commercialisation of microfinance, individual-lending MFIs increasingly focus their efforts on attracting wealthier clients to increase their scale, deviating more and more from serving the poorest of the poor (Hermes & Lensink, 2007).

4.2.3 Has microfinance veered off course?

Microfinance is seen by many as a tool created to alleviate poverty. However, the industry has been under the spotlight, with increasing pressure to expand its scope (number of borrowers reached and number of institutions) (Nurmakhanova et al., 2014). As discussed earlier, we have seen a shift in MFIs' loan offering, switching from group-lending to individual loans with a larger average size. This has sparked a heated debate on whether microfinance has lost its moral compass. On the one hand, some claim that MFIs are drifting away from their main purpose of serving the poor, while, on the other hand, some argue that this deviation is mandatory to assure the sustainability and scalability of MFIs (Mersland & Strøm, 2009).
Financial sustainability is, indeed, a major concern for the microfinance industry. A survey conducted in 2007 revealed that an impressive 41% of the MFIs operating were not financially self-sustainable and were relying on subsidies and donors to keep their operations going. The question is, then, would it better to rely on subsidies or pursue financial objectives with the risk of losing sight of the primary social objectives? Some critics suggest that MFIs are shifting their focus on making profits at the expense of outreach to the poorest of the poor.

In order to assess whether the industry might have lost its way, one should first understand how to determine when an MFI is drifting away from its main purpose. Looking at the existing literature, it seems that there are several clues that could, indeed, indicate a 'mission drift'. The first and, arguably, the most prominent indicator would be the loan size (Cull et al., 2007). As seen earlier, a negative correlation between the size of the loan and the outreach can be observed, with a bigger loan indicating that the MFI is either targeting borrowers with higher incomes or their existing customer base is improving its situation and could then bear more debt (Cuellar Benavides, 2018). According to Mersland and Strøm (2009), other parameters

could come into play. Indeed, the proportion of group-loans in MFIs' portfolios could indicate whether institutions are currently relying more on individuals able to provide collateral, hence being able to receive bigger loans, instead of continuing to serve those who would not be able to give any guarantee. Last but not least, the percentage of rural versus urban loans could also indicate which kind of borrowers the MFI is targeting, as the less well-off tend to be located in rural areas (Mersland & Strøm, 2009).

Looking at the existing empirical evidence, it seems that the results regarding mission drift remain mixed. In an attempt to assess the latter, Cull et al. (2007) proceeded with data analysis of 124 MFIs spread over 49 countries around the globe. They ultimately found that both profit-oriented and outreach-oriented approaches were profitable while serving the poor but found evidence of a trade-off between financial sustainability and outreach when serving the very bottom of the pyramid. Other researchers (Abate et al., 2014; Grahama et al., 2000; Mersland & Strøm, 2009) performed country and region-level analysis and concluded that, indeed, there is a negative relationship between cost-efficiency and outreach to the poor.

On the other side of the spectrum, pro-profit supporters also produced interesting results. Indeed, the Consultative Group to Assist the Poor (CGAP, 2001) conducted an experiment on Latin American MFIs that have been commercialised and concluded that their outreach did not change much. Going further, Fernando (2004, cited by Miled & Rejeb, 2015) conducted research on several commercialised MFIs and found that their financial situation did improve without drifting from their mission.
Overall, we have seen that 'mission drift' could appear at different levels, and, arguably, positive outcomes could still be achieved in the long run. However, history has shown us that as soon as terms like profitability, margins or even efficiency come into play, different human comportments might arise. While the term 'mission drift' has not really been used in the finance or banking industries, one could easily find cases of abuse, such as the Wells Fargo account fraud scandal or the Enron accounting scandal in the early 2000s. Both cases were motivated by pressure to secure ever-increasing profits. The microfinance industry has not been spared, and we will later detail a case of abuse in the industry.

The next section will discuss the phenomenon of information asymmetry, described as many economists as the black sheep of market failure, fostering opportunistic, destructive behaviours. Microfinance has been increasingly exposed to this phenomenon, arguably even more than traditional financial institutions, especially since its commercialisation and with the shift toward individual-lending versus joint-liability lending. As a response, the industry is calling for increased transparency.

4.2.4 Information costs: An asymmetric puzzle

So far, we have seen that low-income clients located in developing countries are often excluded from formal financial markets because of their inability to provide collateral, their lack of credit history and the high risk associated with lending to them. These issues compromise their financial sustainability and scalability and comprise the main reason for their increased interest rates, well above that of traditional financial institutions. However, MFIs have channelled their efforts into providing access to these borrowers through innovative lending methods, such as the joint-liability group lending model (JLLM). The existing empirical evidence suggests that JLLM mitigates issues associated with asymmetric information (AI), for example, adverse selection and moral hazard, by assuming no information is hidden.

Indeed, being monitored and pressured by their peers, borrowers do not have an incentive to behave badly, ultimately mitigating asymmetric information problems. Social and geographical proximity is surely crucial to borrowers in gathering better information about their peers and facilitating the monitoring of each other's actions. The lender's moral hazard (MH) could then be reduced, and incidents of credit default will decrease (Carpenter & Williams, 2010). Consequently, information asymmetry has gained prominence in modern financial inclusion and microfinance theory.

As suggested by Joseph Stiglitz, asymmetric information is characterised by two main aspects. On the one hand, asymmetries are almost inevitable, simply because individuals know themselves better than anyone else does, and asymmetries are highly dependent on market conditions that are, in turn, affected by the existence of such asymmetries (Stigliz, 2002). Applying this to the microfinance industry, one could observe that existing asymmetries become difficult to overcome as it is as challenging to retrieve information from individuals living in specific regions as it is for them to gain access and understand MFIs. Moreover, the existing economic and legal environment in developing countries is arguably more likely to exacerbate the problem.

The two main issues that need to be tackled regarding information asymmetries are adverse selection (AS) and moral hazard (MH). In the microfinance industry, adverse selection stems from the inability of MFIs to distinguish creditworthy and not creditworthy borrowers and the incapacity of borrowers to distinguish between reliable and unreliable MFIs. In turn, moral hazard is the incentive of borrowers to increase their risk exposure at the detriment of lenders because they do not bear the full cost. One could then use a loan for risky projects that would ultimately affect their capacity to repay it, or an institution could apply disadvantageous loan

agreement terms. One could argue that markets with weaker institutions and legal environments could be more exposed to such market failures, and as argued by Garmaise and Natividad (2010), this could ultimately lead to higher funding costs.

As seen earlier, MFIs address information asymmetry through the joint-liability lending model. This is achieved by positive assortative matching, peer monitoring and access to local information (van Zaal, 2014). Group lending is, indeed, a great combination of formal and informal financial mechanisms, combining, on the one hand, the scale advantages of a traditional bank and, on the other, the mechanisms of informal finance (Armendàrit de Aghion & Morduch, 2010). As a result, and by shifting the responsibility of certain tasks from the lender to the borrower, information asymmetries are reduced, and the repayment rate increases (Giné & Karlan, 2014).

Despite the existence of such mechanisms, the difficulty of determining whether a party is telling the truth or not and the existence of such issues point to the importance of a sound regulatory framework and transparency. The next section will discuss these two key components of the microfinance industry.

4.2.5 Ownership structure and transparency

Since its early days, the microfinance industry has arguably received positive attention, being praised as the silver bullet in the fight against poverty. However, critics pointed to the industry's low standards of governance and transparency (Pocantico, 2008). The gap between expectation and reality regarding transparency has been one of the main challenges of the microfinance industry.

The exponential growth experienced by the industry has revealed its weaknesses and brought to the fore cases of abuse by MFIs (see next chapter), causing great reputational harm to the point of questioning the essence of the microfinance movement. The lack of transparency, as well as lack of governance, are major sticking points. Trust mechanisms are flawed, and stakeholders insist on increased transparency along the entire microfinance value chain to re-establish trust and protect the interests of the different parties involved (Roberts et al., 2018).

One could see transparency as being represented by the provision of timely and accurate information to stakeholders. What is important here is that, as per Quayes and Hasan (2014), such transparency could reduce information asymmetries, attract external funds and improve the competitiveness of MFIs. Another important point is that greater transparency could

improve the relations between MFIs and their stakeholders and, thus, foster long-term growth. Indeed, improved relations between all stakeholders could improve the performance of MFIs and prevent over-indebtedness, ultimately enhancing the long-term financial sustainability of the MFI.

What makes microfinance different from the rest of the financial industry is the existence of donors, and what makes the situation even more complicated is that their willingness to fund MFIs ultimately depends on the availability of accurate information on the sustainability and outreach of the MFI under consideration. Indeed, donors are concerned with the social impacts generated by the MFI, even though such impacts are hard to measure and compare. The industry is heavily reliant on donations, and if it intends to continue as it is today, transparency will have to be improved, with more timely and accurate information regarding financials, outreach and impact.

Transparency and governance in the microfinance industry are growing in importance as the key components in addressing information asymmetry and ultimately improving the performance of MFIs. Indeed, feeble reporting and information channels combined with a lack of best practices can lead to poor behaviours that could significantly harm the reputation of MFIs and their positive impacts.

4.2.6 Cases of microfinance failure

As one could expect, providing microcredit in developing countries could not only create risk for lenders but also for borrowers. Indeed, the most common micro-lending methods, which usually allow lenders to collateralise loans while simultaneously collecting the same security, could arguably lead to malicious behaviours. It is true that with the poor legal framework in some developing countries, any lender could call himself an MFI and then leverage the halo effect associated with the industry to encourage creditors to put themselves in vulnerable positions (Duggan, 2016).

The idea behind conventional lending would suggest that only lenders are vulnerable to borrowers, and the reverse is, arguably, not true. In the microfinance industry, the reality is different. In regions where institutions and regulations might be feeble and inadequate, both sides of a lending agreement, that is, borrowers and lenders, could adopt opportunistic behaviours ((Duggan, 2016). On the one side, borrowers could default. On the other side, not only can lenders seize the collateral set out in the lending agreement in case of default but they could also hunt down their clients unilaterally and seize their property even though they

have not defaulted. MFIs' mission is then to make sure that the borrowers repay their debt and leave borrowers alone as long as they repay the loan.

Microfinance's core mission is undeniably not to make borrowers more vulnerable to creditors, which is arguably a consequence of the lending methods used. Indeed, overprotecting lenders could then expose borrowers to ill-intended behaviour. Moreover, if borrowers are unable to distinguish trustworthy MFIs and fraudsters, the overall industry suffers from reputational problems. This reputational loss could have deeper and long-term impacts, and as per Duggan (2016), the behaviour of a small portion of malicious MFIs could destroy value beyond the value of the property that was actually stolen.

Looking at existing cases, countries such as Nicaragua, Bolivia and India experienced micro-lending crises as the exponential growth of the industry generated debt overhang. Debt recovery methods have been called into question after a string of suicides in the state of Andhra Pradesh.
The existing literature focuses mainly on institutional failure, and researchers seem to have overlooked how microcredit transactions in developing countries could create significant risks for borrowers due to the lending contract itself. As per Duggan (2016), such issues have been overlooked, mostly because of the strong selection bias in the samples used.

Abuses in the microfinance industry may not only arise out of opportunistic behaviour by lenders but also from the issues mentioned earlier; that is, high operational costs, the absence of financial sustainability and stability and the presence of mission drift. Indeed, such issues could arguably create incentives for MFIs to veer from their mission while leading to the adoption of harmful lending practices. Last but not least, the lack of transparency and traceability of transactions combined with a legal and regulatory no man's land favour malpractice.

Microfinance is not yet doomed. Information technologies are disrupting many sectors, including finance. Indeed, by redesigning the way each industry operates, such technologies breathe new life in terms of transparency, traceability, governance and efficiency. The next chapter will deal with this thematic.

4.3 Fintechs, a game-changer?

Believe it or not, fintechs are increasingly taking centre stage in the realm of financial inclusion. Indeed, not only has the number of such high-scale financial companies exploded in the last

decade but also the amount of equity in such activities. In this section, we will analyse the opportunities and setbacks of such financial initiatives in the context of financial inclusion.

The existing empirical evidence (Chibba, 2008; Adunda & Kalunda, 2012) shows that the poor and the excluded are being increasingly targeted by financial initiatives and technological innovations such as mobile banking and financial services, prepaid credit cards and automated electronic kiosks. Moreover, a study conducted by the World Bank (2008) pointed out that fintechs could potentially increase the overall efficiency of financial institutions and broaden their scope of action.

Fintechs, the portmanteau of finance and technology, represent the fusion and cooperation of the two worlds and their co-evolution. This new ecosystem refers then to new technologies and innovations that seek to compete with incumbent financial methods to offer financial services. As explained by Triodos Investment Management, fintechs look to reach a broader spectrum of customers in a more efficient, less expensive and more customer-friendly way than the incumbent financial players.

Looking at financial inclusion and the microfinance industry, efficiency gains resulting from the entrance of these newcomers impact operational costs, which could, in turn, make MFIs financially sustainable and small loans financially viable. This claim is supported by Yigma (2018), who states that new technologies could positively influence microfinance efficiency. Indeed, innovations such as mobile banking, biometric IDs and cloud-based storage and management systems for SMEs are bringing down the cost of scaling MFIs, ultimately expanding the outreach of such institutions.

The reduction of transaction and operational costs brought about by the use of modern technologies, and mobile banking, in particular, has the potential to tackle the disadvantages of development for MFIs operating in rural areas. As per Allen et al. (2014), these technologies would be more likely to have an impact on the provision of payments and remittances than on the provision of loans.

By encouraging the use of formal financial institutions in the channelling of payments and remittances, technological innovations have the potential to stimulate the deposit base of banks, allowing them to intermediate more funds in the private sector (World Bank, 2008). What is more, the transfer of remittances can be done by financial institutions to increase their knowledge about their customers and their solvability. With access to such a database, such beneficiaries could ultimately also become borrowers.

Overall, it seems that the adoption of new technologies and delivery channels, such as mobile banking, is a game-changer in the future of financial inclusion. To foster their development, it is critical to work on new policies that will accelerate the adoption of regulatory reforms, innovations and the development of infrastructure networks that could drive down operational costs and enable better delivery of financial products and services to the poor (Adunda & Kalunda, 2016).

5. Blockchain: New hope for transparency

Blockchain technology has come under the spotlight recently, being praised as the next elixir vitae for cheap, transparent and secure transactions. Moreover, blockchain technologies could arguably offer new weapons to fight corruption and facilitate international money transfers.

In the coming sections, we will argue that blockchain technologies (BT) hold the potential to tackle the issues mentioned earlier in this paper. In order to guide the arguments, we will first analyse the relevant existing literature before proceeding to a case study analysing the adoption patterns and adoption outcomes of such technologies.

5.1 What is blockchain?

Blockchain was first brought to light in 2008, and its implementation started the following year (Nakamoto, 2008). As explained in Nakamoto's White Paper, blockchain could be seen as a public ledger, where all committed transactions are organised and stored in a chain of blocks. Moreover, Nakamoto explains how this technology could tackle the 'double-spending' problem[17] and become the foundation supporting decentralised currencies.

The key characteristics of blockchain technology are decentralisation, persistency, anonymity and auditability, which will enable the technology to operate in decentralised environments and is made possible by the integration of different core technologies, such as cryptographic hash, digital signatures (based on asymmetric cryptography) and distributed consensus mechanisms (Zheng et al., 2018). Because BT can work in a decentralised manner, it could ultimately generate large cost savings and improve the efficiency of operations.

[17] Double-spending is a flaw in which a digital currency can be spent more than once. https://www.mycryptopedia.com/double-spending-explained/

As per Kshetri (2017), BT is arguably a tool to tackle issues such as corruption and fraud (which we will talk about later on in this paper) while also reducing transaction costs. Indeed, blockchain, also called decentralised ledger technology (DLT), is a digital (or data) structure that enables the creation and sharing of tamper-proof digital ledgers of transactions, offering high transparency. The encryption allows for access to add to the underlying ledger securely. With this structure, it becomes cumbersome, if not simply infeasible, to alter or erase the data recorded on the ledger.

As a summary, blockchain could be defined as a distributed database of public ledgers of all transactions or digital events that have been executed and shared by different participants. Each transaction in the ledger is verified by a consensus of participants. Blockchain could then be seen as a robust, secure and transparent distributed ledger (Davidson et al., 2016).

Although cryptocurrencies are arguably the most famous application of blockchain technologies, the latter could be used for diverse applications that go beyond digital currencies. Since it allows payments to be processed without any intermediaries, blockchain can be applied to a range of financial services, such as digital assets, remittance and online payments (Peters et al., 2015). Moreover, blockchain is on the path to becoming the most promising technology to support the coming generation of internet interaction systems, such as smart contracts, Internet of Things, reputation systems and security services (Zheng et al., 2018). The application of blockchain is disrupting multiple sectors, including financial inclusion and microfinance.

5.2 Composition of blockchain and its implications

The main purpose of this thesis is not to detail the technical aspects of blockchain. Rather, we will discuss the different elements of a blockchain and their main implications in answering the research question.

As seen earlier, blockchain is a digital data structure constructed by a sequence of blocks. A block is a collection of related information and records and constitutes the basic unit of a blockchain (Wu & Tran, 2018). The data structure of the chain is composed of a block header and a block body. The information contained in the block header is mainly composed of the hash value coming from the previous block, which is, in turn, used to ensure the integrity of the whole chain. On the other hand, the block body will be composed of the main information of the block; that is, the transaction information. Ultimately, this information, combined with the hash value of the previous block and the random number, constitute the hashed hash value of

the current block (Wu & Tran, 2018). The hash plays the role of numerical DNA in which all the data related to a transaction is contained and is embedded in all future transactions. Furthermore, the utilisation of such a function will ensure the integrity of the ledger as, in order to be able to alter or simply modify a transaction, all the previous ones should also be modified at the same time. Otherwise, the number of hashes will not correspond to the existing records in the ledger (Zwitter & Boisse-Despiaux, 2018).

The consensus mechanism is what enables blockchain to keep its integrity and inalterability. This mechanism relies on the 'hashing' explained above as well as on the 'Proof-Of-Work'. The Proof-Of-Work (PoW) is the key element in the validation of each transaction. It works as a mathematical algorithm that will ensure no one can front-run the information concerning the next node that will be used for the transaction validation. Solving this puzzle is called 'mining' and is performed by members of the network (Cuellar, 2018). The validation of the transaction can be rewarding, hence providing an incentive to all network users to take part in problem solving (Zwitter & Boisse-Despiaux, 2018).

The decentralisation of the ledger ensures the blockchain is secure. Indeed, every piece of data and related information is kept in encrypted blocks, and each block is replicated on each computer within the network. As a result, blockchain is an unalterable, safe and transparent record of all transactions that happened in the network (Zwitter & Boisse-Despiaux, 2018).

As per Wu and Tran (2018), there are three levels of openness within a blockchain. The private blockchain, or permissioned blockchain, is a blockchain where only the participants have full access to the information. The consortium blockchain is open to specific organisations and groups, and the public blockchain is fully open to anyone. Regardless of such differences, BTs always share the characteristics of decentralisation, openness, automatic execution contract, traceability, data temper protection, security, credibility and anonymity (Wu & Tran, 2018).

5.2.1 Bitcoin

Bitcoin is a cryptocurrency created after the 2008 financial crisis. In his 2008 White Paper, Satoshi Nakamoto stated that Bitcoin holds the promise of lower transaction costs when compared with traditional online payment systems, noting that it is operated by a decentralised authority. Bitcoin has become truly democratised, reaching a value of USD 19,900 in 2017 from a base of USD 960 earlier that year, amounting to a market capitalisation of up to USD 320 billion.

Bitcoin is an online communication protocol that enables the creation and use of digital currencies and that facilitates electronics payments. Rather than working on a centralised network, Bitcoin works on a transaction ledger that is distributed across a network of participating users.

It is true that Bitcoin is challenged by legal, social and economic issues, as highlighted by the technical anomalies in Bitcoin wallets, but the cryptocurrency has remained robust. Indeed, in testing the robustness of BTs, Bitcoin returned excellent results, exposing the blockchain's ability to resist a wide range of attacks and challenge potential threats (Mainelli & Smith, 2015).

5.2.2 Ethereum-powered smart contracts

The democratisation of blockchain and Bitcoin led to the creation of new cryptocurrencies answering to the different needs of a wide range of industries. Ethereum, established by Vitalik Buterin in 2013, has emerged as the second generation of BTs, allowing for the development and construction of complex, distributed applications, going beyond cryptocurrencies. Indeed, an appealing feature of Ethereum is its capacity to hold self-executing programs. Ethereum enables the creation and application of smart contracts, which can, in turn, support decentralised applications.

Smart contracts are computer programs, or transaction protocols, that run on a blockchain to facilitate, automatically execute and enforce the terms of a contract or agreement. Although there is no universally accepted definition of smart contracts, their utility is increasingly evident. Indeed, they will reduce the need for intermediaries of trust, arbitrations and contract enforcements charges, and by reducing malicious and ill-intended behaviour, they will ultimately cut fraud losses. As per Kong and He (2017), the core functionality of smart contracts is hand transfers at little cost as well as the automation of value transfers based on a decentralised record of the states of the world.

Looking at the finance industry, smart contracts could be a game-changer. Indeed, one can arguably see smart contracts as banks accounts for contracts, safely stored on a blockchain in the form of computer code that will automatically execute and send funds as soon as the set conditions are met in full. As a result, such contracts could drastically reduce the response time during a crisis by automatically dispersing funds to vulnerable populations, such as during a natural disaster or war situation (Hernandez, 2017).

5.3 Opportunities for social innovation

Blockchain is considered by many to have the potential to disrupt the major economic, political and social paradigms that we know today (Kshetri, 2017). Indeed, blockchain affects our systems in many direct and indirect ways. As mentioned earlier, one direct benefit deriving from this technology is the potential reduction of fraud and corruption. Moreover, this technology is now used by a large panel of for-profit and non-profit organisations to tackle issues related to the efficiency, transparency and liability of all sources (public and private) of funding.

Over the last decade, a growing number of ventures have also been leveraging BTs for routing donations and funds in a transparent manner and for granting and managing IDs to refugees, ultimately creating reliable digital identity registries. These advancements are extremely important as a lack of official ID is a major barrier to access services, such as healthcare, or credit and microcredit. While these advancements could promise a bright future for BTs in the development or enhancement of services, questions regarding privacy have also been raised (Zwitter & Boisse-Despiaux, 2018).

Not only could blockchain be applied to banking; it could also be used to reduce barriers and costs associated with property registration, increase the efficiency of international business-to-business trade and promote access to trade and supply chain finance (Zwitter & Boisse-Despiaux, 2018). Moreover, as per Kshetri (2017), the digital properties of blockchain and the fact that it can be fully automatised could reduce costs, resulting in more efficient logistics and IT infrastructure.

5.3.1 Remittances: From FI to correspondent banking

Since their early days, BTs have promised to facilitate financial inclusion and formalise international money transfers and remittances. Over the last decade, the capability of BTs to rationalise and potentially rebuild the infrastructure underlying cross-border money transfers and remittances (i.e., correspondent banking) has been scrutinised by regulators and researchers alike. Correspondent banking relations are bilateral agreements that grant banks the permission to provide services in countries they do not operate in directly. This system was challenged by the 2008 financial crisis, and the infrastructure has undergone a ‘de-risking’ process, greatly reducing the correspondent accounts and increasing their concentration across a smaller number of financial institutions. This ‘de-risking’ process has had a harmful effect on the costs and speed of cross-border remittances (Rella, 2019).

The transactions costs associated with international money transfers have historically been very high. As an example, Western Union charges their customers up to 7% of the funds transferred, and according to Kshetri (2017), transfers done from South Africa to nearby countries could be charged a transfer fee ranging from 5% to 23%, depending on the services used and the origin and destination.

In turn, transactions leveraging blockchain technologies are not bound by any barriers, and the marginal fee charged for transactions is not dependent on the provenance of the funds. Blockchain could then arguably reduce operations and transactions costs in several different sectors. As per Hernandez (2017), a decrease of 5% in operational costs could generate savings totalling 16 billion dollars.

Blockchain technologies are not swimming against the tide in the formalisation of remittances, but rather, these new technologies strengthen the formalisation and capitalisation of remittances. Indeed, by facilitating interoperability and frictionless payments, BTs could stimulate sleeping or unused capital, enhance liquidity and disrupt the money systems surrounding medium-term budgetary objectives (or MTOs), correspondent banking accounts, clearinghouses and central banking settlement systems (Caytas, 2016).

5.3.2 A new mode of identification: Digital property registries and digital identity

BTs have also been applied to land tenure and property rights. These records of land properties are usually kept by governments, but they could be altered or lost, and owners can find themselves without any written proof of their ownership. Successful ventures, such as BitLand Digital Registry, created in 2015 in Ghana, have demonstrated the power of BTs. If we were to take a picture of the current situation, as of today still 90% of land in Africa is unregistered, and one could argue that landlessness is a more direct cause of poverty than financial illiteracy, for example. Kshetri (2017) argues, then, that BTs could be used to address a lack of security, corruption and abuse in the field of property registries.

The continual lack of regulation and rule of law, boosted by a high level of corruption, in developing countries has encouraged the alteration of non-digital registries by malicious individuals. Indeed, land-related frauds are an ongoing issue in developing countries in which the less well-off are the most exposed. With BT implementation, the alteration of such ownership registries would be rendered impossible. Indeed, as per Hernandez (2017),

blockchain, as an immutable, distributed and time-stamped ledger, becomes an attractive tool to tackle issues such as ownership and existence certification.

Around the globe, approximately 1.1 billion people do not have a legally recognised identity. As per financial exclusion, a lack of identity tends to marginalise the affected people, excluding them from democratic, educative, healthcare or economic activity. The underlying structure of blockchain would provide a sustainable way to construct identities from the bottom-up, enabling them to dissociate from any central authority without being modified and put at risk for alteration and theft. According to Kewell (2017), individuals could also obtain the ability to decide which information is made public or not.

As explained earlier, reliable identification combined with property registry rights are central tenets in the development of transaction and credit histories, which, in turn, are the key elements of addressing information asymmetry. Ultimately, this would support risk management when providing financial services, such as micro-lending to the bottom of the pyramid.

5.3.3 Fair trade and ethical sourcing: Traceability

A well-functioning value or supply chain is defined by its ability to support businesses in managing and saving costs, ensuring efficient and faster deliveries, optimising manufacturing times and improving stock management. The efficiency and effectiveness of such chains remain a critical issue for enterprises.

Because of its decentralised, distributed digital ledger, blockchain promises to disrupt the value chain. Indeed, the real power of such technology is its ability to enable proper functioning without any ‘central’ party. Rather than trusting this same central controller to store information, one could then trust the network; that is, all the stakeholders spread across different regions sharing and storing the information. The positive implications for value and supply chains could extend to the development and social realms. Indeed, with increased traceability, BTs could create transparent and fair supply chains, empowering the populations most at risk.

The blockchain ensures that transactions made cannot be altered, and records such as inventories, storage conditions and supply chain follow-up dates like delivery times and dates are all verified and saved securely in the blocks (Thiruchelvam, et al., 2018). Moreover, BTs enable reputation-building, with trading partners linked directly to the blockchain.

The American giant Starbucks has even implemented BT in its coffee supply chain[18]. This implementation involves producers in Costa Rica, Colombia and Rwanda for an experimental period of two years. The coffee chain will be working with Microsoft to lever on its Azure Blockchain Services, enabling the tracking of coffee shipments from around the world, with digital traceability of its value and supply chain. From Microsoft blockchain's side, all changes along the journey will be recorded on a shared ledger, giving a more detailed view of the supply chain. In turn, Starbuck will compile all the information and use it to develop its mobile application, detailing where the beans have been sourced and roasted[19]. Ethical sourcing has been a central pillar of the American giant's strategy, and with the implementation of these new technologies, it is committed to supporting growers and farmers by providing them with data on the entire supply chain of their beans.

5.3.4 A new weapon to fight corruption

Both the public and private sectors have begun to explore the potential applications of blockchain technologies, and some cases have highlighted how blockchain can be used to curb fraud and corruption. As seen earlier, blockchain is based on a tamper-proof digital ledger of transactions that is then shared with different stakeholders, offering transparency and accountability.

Blockchain applications against corruption could be divided into three categories, at the firm level, at the national or within-country level, and at the cross-country level (Kim & Kang, 2019). With the development of international trade, supply has become more and more complex, and it has become difficult, if not impossible, to have a clear and transparent view of an entire supply chain. Indeed, without an integrated supply chain, companies can only gain limited and partitioned views of their bottom-end suppliers. As it becomes nearly impossible to keep track of the movements of primary materials across the different distribution channels, unethical and illicit practices, such as illegal trade, forgeries or practices damaging the environment, could easily emerge (Badzar 2016; Abeyratne and Monfared 2016).

Taking a consumer perspective, there is limited access to information about the origins of a product, and the information available is usually limited to the origin, date of production or the date of expiration. It then becomes complex, if not impossible, to detect whether the product or part of the product comes from illegal child labour or from a country where there are

[18] https://dailycoffeenews.com/2018/03/22/starbucks-launching-pilot-program-for-blockchain-in-its-supply-chain/
[19] https://www.coindesk.com/starbucks-to-track-coffee-using-microsofts-blockchain-service

concerns over mineral issues (Jørgenand Anders 2016). Even though more information is available due to increased regulations, consumers are still at the frontline of this issue and are the group that arguably suffers the most from a lack of transparency.

As per Badzar (2016), this lack of transparency along the value chain can become problematic in the pharmaceutical and medical industries, in which counterfeit drugs can produce fatal outcomes. In this context, blockchain applications on the supply chain have the potential to decrease the opacity for both consumers and suppliers, facilitating contractual coordination.

On a macro-level, BTs are also used by the public sector and the government to increase transparency and fight fraud and corruption. Indeed, blockchain could be used to support many functions carried out by the traditional regulator and reassure the taxpayer of the use of their taxes. Moreover, BTs could be used by governments and financial institutions to tackle issues such as money laundering and illicit activities like drug trade or terrorism (Kim & Kang, 2019). As a matter of fact, with BTs, every transaction is recorded and stored without any manipulation, so the provenance and destination of a product are made transparent.

Last but not least, BT applications on a cross-country level could prove to be a fierce ally in international trade and in the regulation and monitoring of foreign direct investment. On the one hand, with the use of BTs, all counterparties can easily identify and manage the ownership of any trading documents, mitigating the risk of disputes, counterfeits and double-spending. On the other hand, as BTs allow for the recording of all financials on public records, a foreign investor is able to track the flow of money and check whether each dollar is rightly spent (Kim & Kang, 2019).

5.4 Decentralisation: A correction mechanism

Centralisation has long been lauded to be the silver bullet to organise companies and improve efficiency. Indeed, it is arguably the most efficient way to enact, settle and enforce rules. Centralisation helps to avoid duplication, creates hierarchical levels and assures a fair settlement in litigations. That being said, existing literature has shown that centralisation can be problematic if management has the scope and incentive to exploit loopholes. Indeed, according to Davidson et al. (2016), centralisation is bound by trust, which can then be misused when the trust is politically earned. A move toward decentralised systems could increase overall robustness, making the system safer and more efficient. As a matter of fact, trust built on cryptographic rather than political means could become an assurance against rent-seeking behaviours.

From an economic perspective, one could argue that blockchains show similar behavioural characteristics to traditional markets. Indeed, for pure economic transactions or exchanges, markets are usually efficient governance institutions, but as soon as the economic relationship requires a specific amount of time for investment (due to the particularities of an asset), repeated interactions with the parties involved or implies high volatility (or high levels of uncertainty), alternative governance institutions, such as hierarchies (verticality) and contractual relationships, could be efficient tools to tackle opportunistic behaviour.

Society, as we know it today, continues to be reliant on governance institutions to mitigate the uncertainties around trust. Indeed, individuals use institutions, such as governments and banks, as intermediaries to manage uncertainty. BTs, allowing individuals to perform transactions safely and in a transparent manner, could arguably redesign the landscape, erasing the need for any third party to verify transactions (Zwitter & Boisse-Despiaux, 2018). Rather than relying on politically-built trust, BTs are offering individuals technology that leverages smart contracts (cryptographic-enforced execution of contracts), tackling opportunistic behaviour through transparency and consensus regulation. This would arguably mean that opportunism would be completely mitigated within a distributed autonomous organisation (DAO), and mechanisms would reflect those of a market rather than those of a vertically integrated organisation. As a result, BTs could then reshape the way decisions and agreements are made by preventing opportunism.

Applying this to the microfinance industry, one could argue that such technologies could be a game-changer for the industry, tackling the challenges exposed earlier at their roots. By providing adequate tools for regulation and contract enforcement (smart-contracts), BTs become the shield for rent-seeking behaviour and prevent abuse by malicious MFI managers. The next points will discuss how BTs could solve the problems discussed earlier.

5.4.1 Transparency

A lack of transparency is arguably the key issue financial inclusion and microfinance industries are facing. Decentralised ledgers are a means to greatly improve the transparency of transactions and information flows. Indeed, the technology within the DLT will act as a substitute for trust and enable digital transactions to take place between two parties without the need for a trusted third party (Kewell et al., 2017). As a matter of fact, blockchain and DLTs allow anyone to deal with any individual, anytime, anywhere and on a peer-to-peer basis. As an example, money transfers are usually handled by trusted intermediaries such as banks, but

DLTs will reallocate the responsibilities of the transaction from incumbent management to computers and codes.

Information asymmetry is a problem faced by many industries. A broad range of economic and institutional factors will determine the contractual, regulatory and information mechanisms necessary to mitigate information asymmetries. According to Healy and Palepu (2001), '*These factors include the ability to write, monitor, and enforce optimal contracts, proprietary costs that might make full disclosure costly for investors, regulatory imperfections, and potential incentive problems for intermediaries themselves*'.

Healy and Palepu (2001) further argue that measures do exist to reduce information asymmetry. First and foremost, contractual clauses enforcing full transparency between contractors could prevent underlying information asymmetry issues and adverse selection. Second, issues such as moral hazard could be tackled by increased disclosure by governance bodies. Blockchain is the underlying technology of smart contracts, which are intended to eradicate opacity and promote transparency and traceability. This transparency and the fact that all transactions are made available on public ledgers could be a game-changer in creating credit profiles of borrowers and preventing over-indebtedness and assuring fair interest rates. Taking it a step further, such transparency will greatly ease governance work (reporting and control) by regulatory bodies, which could favour best practice in the financial inclusion and microfinance industries.

5.4.2 Reduction of transaction costs

Information technologies are characterised by three laws. First, and arguably the most famous, is Moore's law, which states that the number of transistors in an integrated circuit doubles every two years, decreasing the cost of processing information exponentially. Second, Kryder's law states that disk drive density doubles every 13 months, which means that the cost of storing numerical information decreases exponentially. Last but not least, Nielsen's law affirms that Internet bandwidth grows 50% each year, meaning that the cost of transferring digital information decreases exponentially. In this context, one could argue that decentralised technologies such as blockchain are likely to be cost-efficient when compared to centralised systems.

Transaction costs are directly influenced by three components of the transaction costs theory: asset specificity, transaction frequency and uncertainty (Williamson, 1987). As a transparent public ledger of transactions, the blockchain environment will put pressure directly on these

components, reducing transactions costs. A study performed by Garmaise and Natividad (2010) revealed that the credit history of borrowers has a non-negligible effect on reducing the cost of funding for MFIs, with the uncertainty surrounding borrowers and their credit risk being mitigated. As seen earlier, BTs can facilitate the gathering of relevant information, opening the way for new credit evaluations using smart contracts.

5.4.3 Self-regulation: Taking responsibility for one's actions

As seen earlier, moral hazard is a recurring problem, and one pursuing their own interests at the expense of a counterparty could jeopardise the benefits for all parties involved. According to Buterlin (2015), '*Blockchains are not about bringing to the world any one particular ruleset, they're about creating the freedom to create a new mechanism with a new ruleset extremely quickly and pushing it out. They're Lego Mindstorms for building economic and social institutions.*' As suggested by the author, BTs are the bricks for building economic and social institutions. Going further, such technologies will enable the execution of rule-systems, such as smart contracts and DAOs, that facilitate bespoke socio-economic coordination (Davidson, De Filippi, & Potts, 2016).

Reputation does not have the same value within a centralised system as it does in an open, decentralised system. As a result, although the parties involved might be in dispute over a contract, a common interest in conserving the integrity of the blockchain remains, not only because of the value their reputational capital has within an open, decentralised system but also because of the value of future actions and transactions. Going further, one should also expect screening and signalling to evolve concurrently to tackle information asymmetries within contracts (Davidson, De Filippi, & Potts, 2016).

In the microfinance industry, regulations are linked primarily to operational and financing costs. As a result, the benefits stemming from regulations can be diluted by such costs (Mersland, 2009). BTs have the capacity to enable transparent and cheap self-regulation, opening the way to regulations that could prevent ill-intended behaviours by MFIs' managers and employees.

5.5 Obstacles for blockchain technology solutions

From farming to banking, a growing number of industries are now looking into the potential blockchain solutions offer in terms of transparency, traceability, speed of processing, cost

efficiencies, and so on. Although the benefits are arguably completely disrupting the way we operate, obstacles and bottlenecks that hinder its universal adoption remain.

While some researchers laud blockchain technologies to be the silver bullet in fundamentally changing the way our society communicates and operates, some observers point to the limited scalability of blockchain, mainly because of the set size of the constituent blocks and the energy and internet bandwidth requirements. As per Ganne (2018), this scalability issue is particularly true for public blockchain, but it is lesser a challenge for consortiums and private blockchains, which, as seen earlier, are not as constrained.

With blockchain's ability to scale comes the question of energy consumption. Environmental impact is centre stage on the world's agenda, and increased use of DLT could be a hindrance in reducing carbon emissions (Ganne, 2018). Indeed, the whole validation process for blocks can require extensive programming and computational power and, thus, energy needs, which could have a direct impact on the scalability of BTs. The additional required bandwidth needed to power transactions across the whole network could be exacerbated in developing countries where network congestion is a recurring problem (Kshetri, 2017). Although BTs have had a significant impact on transaction costs, traceability and the development of digital property and citizen registrations, some argue they might be hindered by the complexity of the underlying technology and their bandwidth and energy requirements (Zwitter & Boisse-Despiaux, 2018).

Nevertheless, new technologies and processes are not etched in stone but evolve by iterations over time. History has shown that the technologies that have lasted are the ones that managed to respond to challenges. This could also be applied to BTs, and their complete democratisation and adoption will depend on the development of more energy-efficient algorithms (Ganne, 2018).

As for finance, one of the main challenges of BTs is the lack of literacy of such technologies, creating psychological barriers to their adoption. Moreover, the current lack of accessibility and user-friendly interfaces also constitutes a hindrance to adoption. These barriers have been exacerbated by the limited awareness of BTs among key players in the microfinance industry. As argued by Kshetri (2017), education should start with MFIs, who could arguably be more familiar with BTs in order to educate their customers in a top-down manner.

In order to leapfrog such barriers, BTs, and the underlying solutions enabled by DLTs, should be designed to answer to the needs of their users. They should be designed in an ethical manner, not only taking the need of MFIs into consideration but also the needs of all

stakeholders in the industry, paying careful attention to the digital fractures and imbalances that could arise. Indeed, there is arguably a strong tendency for the high-end to adapt faster to new technologies and the underlying transformations. Empirical evidence has shown that the less well-off are less likely to be online or to simply have the digital education required for BTs, which will inevitably amplify digital inequalities (Hernandez, 2017).

Although BTs are highly resilient due to their decentralised nature and their use of cryptographic mechanisms, they are not immune to security breaches. Although the immutability of the information within a blockchain and the automatic execution of smart contracts sounds appealing for financial institutions, concerns regarding privacy rights and security remain.

The potential to assure full transparency or even create immutable ID records could indeed stimulate competition, but such disclosure amongst stakeholders may not have the expected impact. Indeed, full transparency within a value chain could lead to a breach of credential data and metamorphose market mechanisms in an unwanted way (Kim & Kang, 2019). Moreover, immutable ID records could arguably create rigidity by simply taking away human appreciation (Zwitter & Boisse-Despiaux, 2018), which would not be desirable for microfinance and financial inclusion, especially in developing countries.

As seen earlier, due to the high level of computational work required, blockchain is an energy-intensive technology. Indeed, in order to work properly, such technology will require high server capacity and processing capacity. Such requirements could hinder blockchain's development, especially in countries with limited power infrastructure and a lack of internet access.

The high energy consumption of blockchain mainly stems from the Proof-of-Work (PoW) method used in the validation of all transactions and the hardware used to operate the network. Miners commit extensive resources to verify all transactions, which makes the PoW method computationally intensive and arguably costly and wasteful of resources[20]. As a point of comparison, Bitcoin is able to perform seven transactions per second, while established transaction and ledger technology players, such as Visa, are able to perform 24,000 transactions per second (Koticha, 2018).

Last but not least, one should underline the role of a legal framework in a blockchain context. Indeed, a solid framework is essential for proper implementation of such technologies and for

[20] A study conducted by Aste (2016) estimated that around 1 billion watts are used every second to make a valid PoW for Bitcoin.

blockchain to reach its full potential. As per Zwitter and Boisse-Despiaux (2018), BTs, in the context of humanitarian laws, will have to comply with international legal frameworks, such as the Human Rights Law or the International Humanitarian Law. Microfinance is at the crossroad between humanitarian and financial domains, which could become cumbersome when trying to comply with both legal frameworks in designing solutions.

6. Practical Case: AgriLedger, blockchain-powered farming

'If you eat food, you are involved in agriculture.' - Genevieve Leveille, Founder of AgriLedger

The mission of AgriLedger is clear: providing the right tools for all stakeholders in the agricultural value chain and improving the food supply chain to create opportunities for farmers, who are not always compensated properly. The two main axes of AgriLedger are creating the opportunity for individuals to demonstrate ownership along the value chain and creating entrepreneurs out of small farmers by giving them access to the market and financial services to ultimately empower them and show them what 'quality' looks like.

It has been reported by the UN that up to 50% of crop value is lost in the value chain between the farmers and the point of sale of their products and the market. The founders believe that working closely with small co-operatives will, in turn, enable local farmers to sell their products collectively to the market, and the problem can be solved using blockchain. The current operational status quo of co-operatives is mostly paper-based records, tacit agreements and other verbal promises. Arguably, these could lead to transparency issues, limited access to data and information and, ultimately, fraud and corruption. Here comes AgriLedger.

AgriLedger is a mobile application that records information about farmers' crops, and the information is safely stored on a blockchain, creating a permanent and immutable record of all transactions that have taken place. Indeed, their solution aims to create a high standard of ethics and integrity along the agricultural supply chain by tackling transparency issues and improving information flows. This solution aims at giving access to farmers to a wide range of digital information, including weather information, seed provenance, fertilisers used and crop locations. AgriLedger aims at improving the quality of life of less well-off farmers, in line with some SDGs and boosting local economies.

The product's offering, based on the underlying blockchain technology, includes the below attributes:

Digital Identity: By providing relevant information, all stakeholders in the supply chain will be able to easily register and create an account.

Asset Digitisation: Commodities or assets, such as crops, rice or cocoa, can be digitalised via tokenisation. This process, which consists of substituting a product with a non-sensitive equivalent that has no marketable or usable value, could create liquidity, assist trade and boost the value of underlying commodity markets with the participation of key members.

Immutable Data: AgriLedger's platform is built on DLT, which provides immutability to the stored information. Such immutability creates trust, transparency and traceability along the supply chain.

Financial Services and Record-Keeping: Without proper financial access, many farmers could lose up to 50% of their potential income. With BTs and DLT, farmers are now able to leverage better record keeping and proof of income that makes it easier for them to access supply chain finance, credit and other financial products and services. Being in better control of their finance, they can then arguably increase their income.

Digital Wallet: A digital wallet is a software-based system that will gather and safely store users' payment information. By using a digital wallet, farmers will be able to apply for and receive direct financial services from financial institutions. Moreover, financial transactions along the supply chain (from farmers to final buyers) will be implemented, ultimately boosting the speed of payment execution and increasing overall efficiency.

AgriLedger's network coordinates all stakeholders in the agricultural supply chain (farmers, transportation providers, wholesalers, seed providers, etc.) and works with multi-national companies, NGOs and governments in order to address challenges on a global scale. They are actually the sole player offering a solution for traceability and transparency for the agricultural ecosystem, tracking the product from the seed to the final consumer.

Overall, AgriLedger seems to be a technology that could disrupt the agricultural industry and make a difference. As stated by their co-founder and CEO, the company is currently looking at the applicability of their technology to developed countries, even though, at least for now, it is the third world that needs it the most.

What is next for AgriLedger? Their short-term agenda seems to include the development and deployment of a SaaS-enabled market place. This application will work as a communication

and order management system, which will source agricultural commodities from suppliers and retailers in the food industry. Leveraging data analytics and machine learning, the platform will aim at creating a personalised purchasing experience by digitalising the sourcing behaviour of stakeholders.

AgriLedger is a good example of how BTs could act as a correction mechanism by tackling traceability and transparency issues. BTs are not the solution to all the problems in the world, but they make information more trustworthy; the next step is then how do you take that data and make something out of it?

7. The future of blockchain in the microfinance ecosystem

The previous chapters have examined the context of blockchain in microfinance, seeking to analyse the current status quo of financial inclusion and investigating both the setbacks and opportunities for new fintech technologies. We then drew a panorama of blockchain and its underlying mechanisms to determine how the technology could address the challenges of financial inclusion.

Financial institutions, being the middlemen between the supply and demand of capital and thus holding the role of intermediary, could be greatly disrupted by BTs, and the implementation of DLTs could arguably reshape the financial inclusion landscape. Indeed, with full implementation of BTs, each stakeholder could be directly linked to each other, such as, for example, savers connected directly with the purchasers of capital. Such mechanisms then have the potential to reshape the structure and role of MFIs.

Blockchain paves the way to a whole new panel of players along the supply and value chains that could support the implementation of such technologies. For example, because of the work that has to be done to educate people on how to use these new technologies, new players could specialise in creating digital education tools and providing software development for MFI blockchain implementation.

Within this landscape, cases of other external players providing specific financial services have been observed. As an example, the Mexican giant Cemex (specialising in cement) has been helping the less well-off by supplying professional storage space and by serving as an intermediary for distributors of construction material. BTs have helped the distribution of such services via the use of smart contracts and the creation of credit records.

Decentralised finance, or DLT-powered finance, could disrupt the actual status quo of financial inclusion and microfinance. Indeed, as seen previously, a blockchain that could hold a transaction rate similar to Visa, MasterCard or PayPal, combined with well-structured smart contracts, could lead to the emergence of new, more efficient MFIs that may be able to connect all stakeholders with a greatly reduced fee per transaction. Moreover, decentralised finance could lead to the more efficient allocation of funds and to reduced interest rates, ultimately supporting the outreach of the industry.

Looking at finance use-cases for BTs' application, and as seen in this paper, we could argue that such technologies have the potential to disrupt the microfinance industry by tackling recurring and structural challenges in the underlying operations. On the one hand, such financial institutions could take advantage of the structure of the blockchain (the immutability and openness of the underlying ledger) to create reliable and useful credit records for their risk assessment and management, while using smart contracts for the recovery process could increase the overall efficiency and reduce the need for collateral. Moreover, the automation of the transaction recording process could assist in reporting, making it more efficient and transparent.

Decentralised finance could also be used to support other financial services, such as the provision of cross-border remittances, savings products and insurance contracts. The use of BTs for such services could enable better outreach without necessarily increasing risk. As per Cuellar (2018), the cost to set up the infrastructure for such remittance payment schemes could be greatly reduced with proper implementation of the blockchain, integrating this kind of payment scheme directly alongside micro-credit and savings products. Last but not least, the use of smart contracts could greatly reduce the risk of abuse.

Taking a closer look to the case study, it becomes clear that BTs have an impact on the way business is conducted. In the case of farming, we have seen that within the agricultural supply chain, farmers are often the injured party, ultimately selling their goods below the market price, suffering from structural flaws of the system and being excluded to financial services. Overall, we have seen that the industry was suffering from a lack of transparency and trust that could lead to flaws in coordination and an increased corruption.

Via their Blockchain powered application, Agriledger initiated to improve transparency, trust and the decision making power of farmers. Indeed it helped farmers create and keep financial capital by creating new technological tools that gave them a greater trust all along the value chain.

Diving into more details, the Agriledger application has enabled farmers to keep track of their products and gave them better book-keeping solutions (digital vs paper-based). Ultimately transparency and efficiency have been improved by collecting all transactions information via the application. Moreover, because of an increased traceability, farmers are gaining more pricing power and then see improvements in their income. This case study then showed us how Blockchain are tackling the main challenges exposed in this research paper.

Based on what has been argued in this work, BTs could change the microfinance landscape by acting as a correction mechanism for the existing structural flaws.

8. Conclusion

The microfinance industry has been lauded to be a silver bullet in the fight against poverty since its creation. Although there are still concerns regarding its mission and its depth of impact in reaching the poorest of the poor, empirical evidence shows that it is still an important tool in supporting financial inclusion and economic development in developing countries.

Since its early days, microfinance has been through an iterative evolution, becoming more sophisticated with time. However, challenges remain, which hinders the potential of MFIs. Indeed, information asymmetries act as a brake for initiatives aimed at reducing operational costs, achieving financial sustainability and managing risks. Tackling such asymmetries could unleash MFIs' full potential, enabling them to increase their outreach.

The financial sector has come under the spotlight in the last decade, experiencing a drastic transformation with the advent of new technological players. Blockchain, amongst all technologies, could reshape the industry, and as argued in this paper, has the potential to disrupt the financial sector by addressing trust issues and information asymmetries. Indeed, the structure of this technology (its immutability, decentralisation, security) could prevent abuses and protect the poorest of the poor. The coming challenges will reside in educating potential users about the technology (i.e., improving digital literacy), the volume of transactions that the technology can handle, and issues related to privacy rights and regulation. BTs are able to accelerate financial inclusion, but whether or not they will disrupt the status quo will greatly depend on their ability to mature quickly and gain the trust of users.

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