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Configuration Manual

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MSc Project Submission Sheet

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I. SECTION 1

PEER-TO-PEER LENDING AND REGULATORY REGIME IN SOCIO-TECHNICAL TRANSITION: THE CASE OF CONGOLESE INDIVIDUAL LENDING TRANSITION

1.1 Individual Lending Transition

The rapid growth of Information Communication Technology (ICT) also exemplifies a rapid development of technological innovation, despite the global economic slowdown, yet financial technology is rising in different part of the continent, and Africa has embraced this new financial service model commonly known as Peer-to-Peer online lending, which has given much African access to funds without knocking at the traditional financial institutions' door.

In the case of Congolese Individual lending transition, people in the Democratic Republic of Congo DRC are novice to this new financial trend, but the increasing youth growth rate in terms of population continues to grow exponentially, and this new generation is eager to engage into the technological trend, the social media network, online chat. There is certainly a need for innovation, digitalisation, hence, the desire to access funds for entrepreneurial purposes, yet conventional banks or other lenders charge high interest rates, huge collateral in most of cases a title a deed making it difficult for businesses to expand or a start-up.

Most of the traditional financial institutions have tremendously changed their business models to fit in and meet the technological innovations' demand as the emergence and development are unquestionably evident (Arner et al., 2015), and justified due to the high volume of individuals applying for capital flows, followed by manual administrative hassles that cannot be kept by traditional banks (Agarwal and Hauswald, 2008).
Peer-to-Peer (P2P) lending already existed for a decade in the Democratic Republic of Congo and is still in its informal, however, the financial technology brought the emergence and development of Peer-to-Peer lending to another level and impacted the lending behaviours of each individual borrower and lender, thus enabling a smooth transition of individual lending sectors.
This can result in higher returns for lenders, at the same time provides better financial inclusion, comprehensiveness, and openness for borrowers (Agarwal and Hauswald, 2008, Moenninghoff and Wieandt 2013, Namvar 2014).

However, the authorised financial institutions' lack of involvement is due to an insufficient regulatory framework regarding the lending process on Peer-to-Peer (P2P) lending platforms, which means that lenders have almost no level of protection from regulators, that every lender that participates in online lending activities has a higher risk of exposure on his/her investment ((Emekter et al., 2015). Most scholars' attention has been focused on this novel financial sector, which led them to be concentrating on lending studies' factors such as "the impact of a success rate of acquiring loans" (Ciuchta and O'Toole, 2016; Freedman 2017) and "default risks" (Malekipirbazari and Aksakalli, 2015).

1.2 Social Technical Transition

Along with the exponential development of information and communication technology (ICT), increasing technological innovations are effectively being developed and disseminated in modern society.
The Social Technical Transition has significantly been increased and accepted to explain and guide transitions and to analyse social and technological changes caused by radical innovations (Geels, 2004; Whitmarsh, 2012). In other relevant literature reviewed, it was found that existing studies put more emphasis on the transitions that are taking place in other domains and sectors, hence, the main role of regulation in transition processes is to some extent being ignored. Moreover, the two-way directional niche regime interactions require further research endeavour to investigate. Additionally, based on the review of the studies that focus on the regulatory regime, it was discovered How and to what extent the regulatory regime can affect the development of innovation

1.3 Regulatory Regime

The concept of regulation has been differently interpreted by some scholars and researchers, given different definitions. According to (B. Baldwin et al, 1998), regulation is recognised as an identifiable and distinct mode of government activity.
Many researchers perceive regulation as a responsive tool to achieve risk mitigation and reduction (Haines, 2011).

1.4 Research Design

According to Crotty (1998), the research design takes theoretical rationales, research methods, and research strategies into consideration. In this regard, the theoretical rationale is based on the research aims and also research questions., hence, this research takes on an approach of critical realism because it is well suited for the exploration of generative mechanisms in evolutionary processes (Danermark et al, 2002).

Additionally, a reproductive research strategy is adopted in this research. The hypothetical model is considered to construct the Individual Lending Transition framework, so based on the hypothetical model, an analytical framework was developed that took into consideration both macroscopic transition processes and microscopic bi-directional interactions between the niche and the regulatory regime.

The Use of the bottom-up approach in this research report is necessary to discover the generative mechanisms from specific observation to generalisation and subsequently used an abductive approach to uncover how people conduct themselves and their perception of the changing social world.

An in-depth case method was adopted in this research because it is suitable to address "how" research questions, and concentrates on modern ongoing phenomena, in the area in which the investigator has no control over behavioural occurrences (Yin, 2017)

The case in Chapter is the Congolese individual lending transition, which was initiated by the rise and development of Peer-to-Peer (P2P) lending platforms in the Democratic Republic of Congo DRC Sub-Saharan Africa.

Fieldwork that was carried out for data collection from June to August 2022. Both documentary research and online channels/phone calls and semi-structured interviews were carried out during the fieldwork, and hence, both primary and secondary data were taken into consideration.

While conducting the fieldwork, a total of 20 industry reports and 50 news reports were collected. Additionally, 24 formal interviews were conducted. The interviewees were journalists, Peer-to-Peer (P2P) users, staff from Peer-to-Peer (P2P) lending platforms, commercial banks, and regulatory authorities. Further details regarding data collection and data analysis are addressed.

1.5 Key Findings and Contributions

According to the framework of Hood et al. (2001) building on governance, which emphasises the concept of the regulatory regime in regulatory processes, a broadened regulatory regime trajectory in Socio-Technical Transition was identified. t is noted that there is a gap in terms of time between the development of the Peer-to-Peer online lending innovation and the regulatory regime which is the result of a lack of expertise and experience in regulation matters, better regulation requires constant and ongoing modification. Moreover, taking into consideration factors such as the criteria of accountability, due process, expertise, and efficiency suggested by Baldwin et al. (2012), forced self-regulation has been identified as an appropriate regulatory strategy to regulate the development of radical innovation, where external regulators assign regulatory functions to entities to oblige them to formulate rules (Efklides, 2008).

Furthermore, during the transition processes, along with the rise of each key event, Peer-to-Peer lending and the regulatory regime constantly put a sort of standard/ normative onto each other. This explains the more regulating pressures that were given originating from the regulatory regime as the regime orientation and organisation became more and more complete. In addition, cultural cognition, perceptions that people take for granted (Scott, 1995), were the main key drivers for the development and promotion of the regulatory regime at the initiation phase and before it reached dynamic stability at the end of the phase.

Furthermore, this research is a complementary work to existent Socio-Technical Transition literature on the topic of transition governance by examining appropriate regulatory strategies for radical technological innovations of Peer-to-Peer online lending platforms and widens the scope of Socio-Technical Transition literature by investigating a transition in the financial sector. Peer-to-Peer lending is getting more attention as the emergence of technological innovation has gained ground in East and West Africa, so Sub-Saharan African countries, and the Democratic Republic of Congo DRC in particular.

For this cause, consequently, the emphasis has been put on different regulatory measures which have been consistently under pressure for a while and finally, achieving dynamic stability at the end of the stabilisation phase cycle.

These findings add to existent Socio-Technical Transition literature by examining the role of regulation in Socio-Technical Transition processes and also examine the bi-directional niche-regime interactions in Socio-Technical Transitions. The layout of the impact of the adoption of the online Peer-to-Peer lending and regulatory regime were identified. Hence, this further contributes to improving existing literature on regulatory regimes and Peer-to-Peer lending. Additionally, a broadened trajectory of regulatory regimes in Socio-Technical Transitions was identified and it is useful for coordination analysis of and interactions between innovations of Peer-to-Peer online lending and regulatory regimes in transition processes.

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an appropriate regulatory strategy to regulate the development of radical innovation, where external regulators assign regulatory functions to entities to oblige them to formulate rules (Efklides, 2008).

2. Chapter 2: RELATED WORK

2.1 Introduction

The review in this chapter focuses on the existing literature related to this research. There is an increased number of scholars who have shifted their focus away from the technological transition to the social-technical transition
With regard to social-technical transition on the rise and development of technology as well as society in general, the underlying multi-level perspective is regarded as the right technique and helpful approach through which we can conduct an analysis of innovation development and transition processes (Markard et al.,2012; Whitmarsh, 2012).

2.2 Social Technical Transition

Social Technological Transition does not put an emphasis on technological change. Instead, it is focused on the evolution of both technological innovation and society, taking into consideration relevant factors such as Human-agency, technology as well as institutions (Geels, 2004). However, with this three-level conceptual framework consisting of niche innovation, socio-technical regime, and external landscape, the Social-Technical Transition approach has quite often served as a reference for a transition analysis strategy at multi-levels (Geels, 2002).Thus, the section of this report introduces the concepts and related work studies of Social-Technical Transition

2.2.1 Social-Technical Systems

This concept of Technological transition emanates from sustainability research (Kemp, 1994). The technological transition gives in-depth detail on technological innovations' occurrence and how they are integrated into society. A wide large of this process involved has been accepted beyond the technological changes, but also on the social structure reconfiguration level (Geels, 2002).

2.2.2 A Multi-Level Perspective

The merges of mixed elements and the coordination of different groups play a big part in the stability of Socio-Technical Systems. From an evolution economic perspective, Nelson and Winter (1982) detail the inertia of technologies through the concept of

technology regime, which is the result of organisational and cognitive routines. The trajectories are thus formed as correspondent routines and the same portion of sets of rules are shared within a community.

2.2.3 Dynamics in Socio-Technical Systems

With regard to the Multi-Level Perspective, there are different types of interactions of different social groups implicate in the different types of change in Socio-Technical Systems. (Geels and Kemp, 2007) identify three kinds of dynamics in a Socio-Technical System which are: reproduction, transformation, and transition.

2.2.4 Pathways of Socio-Technical Transitions

According to (Smith et al., 2005) transitions take their origin from interplay processes, that occur at different levels and different adjustments of interactions between levels, that result in different pathways of Socio-Technical Transitions. It is suggested by Geels and Schot (2007) that gaining knowledge and understanding of a pathway is the backbone of the analysis of Socio-Technical Transition.

2.2.5 Regulation Concerns of Socio-Technical Transition

The regulation of social-technical changes aims to reduce the risk of threats that new technology innovation conveyed and set out protective barriers around social values (Moses, 2013).
The social-technical change recognizes that constant changes over a period of time are not only caused by technology, instead, but more focus should also be on the development and diffusion of the innovation, rather than relying specifically on invention alone. As new technological innovation implicates Social technical transition, regulators are obliged in a certain measure to ameliorate capabilities and efficiency to positively impact the innovation's development trajectory.

The regulatory regime is asserted to be vulnerable in Socio-Technical Transition, particularly in an online environment (Murray, 2007; Moses, 2013). Oftentimes, new socio-technical practices are affected by the existing regulatory regimes, in contrast, will change them. Consequently, with regard to the regulation of technological innovation in Socio-Technical Transition, more attention needs to be placed on the interplay between different sectors in society (Grin et al., 2011).
Instead of concentrating on the regulation aspect of technology, regulators need to conduct a brainstorming gathering whereby discussions should be more focused on minimising the risk of threat/harm conveyed by the technological innovations and ensuring that stakeholders' interests are protected and how the regulatory regime will progress.

2.2.6 Existing Studies on Socio-Technical Transition

Socio-Technical Transition is to some extent new research topic. To have a clear insight into this field, relevant literature was reassessed. Most of the literature was accessed via Websites with the description detailed in the title "Socio-Technical Transition". Papers were identified in total 10. Each of these papers is strictly reviewed to find out whether they were independently relevant to this research. The focus of each study related to the related work (literature) regarding Socio-Technical Transition is classified into six groups as follows: Theoretical enhancement, niche innovation development, socio-technical regime change, external factors for transitions, the interaction between different levels, and analytical usability. Socio-Technical Transition studies are unfolded through analysis, and research gaps are observed, identified and listed in the summary subsection.

2.2.6.1 Niche-innovation development

The rapid growth and development of technological innovation have indeed been identified as the main factors that lead to social-technical transition. We noted that once the transition is triggered, how to obtain better results during the transition processes, from the point of view of innovation perspective.

2.2.6.2 Social-Technical regime change

The evolution of one regime has been identified according to Rotmans et al. (2001), which are the four stages of transition: pre-development, take-off, acceleration, and stabilisation. With respect to the four transition stages, the following have also been identified: conflicts, adaptation, resistance, and socio-economic losses in the social-technical transition process, enabled by different actors, and where innovations have replaced old practices. We certainly believe that in the processes of new technologies and new practices replacing old ones, there are both conflicts and coordination between actors at different levels. The "How" is imperative to reduce conflicts and in the social-technical regime through which conflicts are reduced and foster coordination which is important to minimize socio-economic losses and attain a certain level of achievement for better transition results and requires additional research efforts to unravel. be identified.

2.2.6.3 External factors for transitions

According to Geels (2016), with the exception of Niche Innovations and regime actors, some large-scale elements also have an on impact social-technical transition processes, and these elements are considered external factors to transitions. Such as the institutional change that has a greater influence on the transition pathway. The fact that institution changes, consequently, influences the transition pathway (Geels, 2016) and institutional constraints are found to be as important barriers to Socio-Technical Transitions.

Moreover, Cai and Aoyama (2018) assert that broken bureaucracy causes institutional misalignments, which brings about the incapability of overriding pervasive and complex challenges in Socio-Technical Transition. Deborah A. Bräutigam, and Stephen Knack (2014) state that disorganized bureaucracy results in institutions being improperly aligned, leading to the inability to override and complex challenges in Social technical transition in the Democratic Republic of Congo DRC Sub-Saharan Africa. There are other elements apart from the niche innovations and regime actors that impact the processes and pathways of Socio-Technical Transitions. Amongst those external factors, for instance, institutional change can also influence the transition pathway (Geels 2016). Conversely, institutional constraints are recognised as important barriers to Socio-Technical Transitions. Thus, these external factors can either be shelters or barriers in perspective for any innovation development. (Geels, 2002, Smit et al., 2005).
Different alignments of interactions that come between levels emanate in different pathways of Socio-Technical Transition (Smith et al, 2005).

2.3 Regulation and Regulatory Regime

According to Levi-Faur (2011, p.13), it is of great importance and usefulness to concentrate on the fundamental notion of a regulatory regime, for certain theoretical, methodological as well as empirical purposes, rather than simply focusing on regulation as a stand-alone rulemaking.
Regulation has a major contribution to the rise and impact of Peer-to-Peer (P2P) lending platforms and Fintech as a whole. Hence, its implications and enforcement are desperately needed in Central African countries, in this case, the Democratic Republic of Congo DRC. The Post-financial crisis in 2008 is an illustrative example of this, as financial regulation has consequently increased the costs in the financial services sector, thus opening doors for opportunities and innovations.

2.3.1 Definitions of Regulation

In fact, regulation has several definitions according to people's perceptions, which makes it difficult to have a precise definition in this regard. The term itself regulation is often used for a myriad of discursive, analytical and theoretical purposes that require enlightenment and explanatory notes (Baldwin et al, 1998; Black 2002; Parker and Braithwaite 2003). From a public or governmental entity, the perception of regulation is considered to be an identifiable and discrete mode of government activity. Additionally, on a smaller scale, regulation is interpreted as a mixed set of rules and commands that are exerted by a public entity, agency or government. On the other hand, it is also regarded as standards and policy documents that exclude judicial procedures and the criminal justice system.

2.3.2 Rationales of Regulation

The emergence of technological innovation in Central African countries has increased awareness in the field, as complex real-life cases are arising and becoming popular in the field of regulation. Krasner (1982, p. 185) noted that a regulatory regime is outlined as the principles, norms, rules, and decision-making procedures around which regulators and other actors come together in a given issue pitch. From point of view of economists, criticisms of public interest theory also justify the contradictory understanding of the rationale of the regulation. (Peltzman, 1976) noted, that it is emphasised that regulatory developments are driven by the particular concerns of interest groups, instead of the pursuit of public interest. Furthermore, the Congolese people have shown their willingness and interest in Peer-to-Peer platforms, thus, as its adoption is still taking place, it demonstrates that this particular sector has been selected as the interest group, Therefore, the focus should be on it and resources should be allocated in the sector, because regulation has proven to be a justified method to achieve social solidarity beyond responding only to market failures yet no bills in the house of parliament, neither a regulatory framework by the Central bank of Congo DRC was examined nor implemented.

2.3.3 Categories of Regulation

Balwin et al, (2012), suggested five stages of a regulatory process model that includes detecting, responding, enforcing, assessing and modify that from a direct state regulation perspective, which is an approach adopted by governments to influence the industrial, economic and social activities through many ways such as prompt to act, being responsive to inform and protect rights

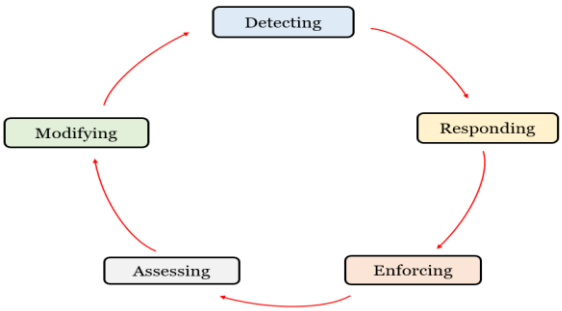


Fig 1: Category of regulation

- Detecting stage: regulators gather information related to the regulated community
- ***Responding stage:*** regulators examine and develop rules, policies and tools to deal with issues/problems encountered
- ***Enforcing stage***; regulators execute and implement the instruments of regulation
- ***Assessing stage***: regulators analyse and evaluate the defined objectives and the results if they have met the requirements of the enforcement activities.

- ***Modifying stage***; regulators set out brainstorming sessions as to whether to adjust instruments and other strategies required to improve high levels of compliance

Regarding Peer-to-Peer lending platforms in the case of the Democratic Republic of Congo (DRC), regulators are at the detecting stage, which explains the baby steps taken by policymakers at parliament and the Central Bank of Congo to set out a regulatory framework in this financial services segment, although a large number of actors are favourable for financial ecosystem and inclusion.

2.3.4 Regulatory Regime

In 2021, the European Union officialised the European Crowdfunding Service Providers License (ECSP) at the national and European levels for platforms willing to operate within the EU. The emergence of technological innovation in Central African countries has increased awareness in the field, as complex real-life cases are arising and becoming popular in the field of regulation. Krasner (1982, p. 185) noted that a regulatory regime is outlined as the principles, norms, rules, and decision-making procedures around which regulators and other actors come together in a given issue pitch.

The two components of the Regulatory regime in Sub-Saharan Central Africa in the Democratic Republic of Congo (DRC) in particular, which are regime orientation and regime organisation are well-established in some related areas where regulation is required, however, the emergence of technological innovation has disrupted these regimes to be amended accordingly.

In addition, the Regulatory regime has been challenged with respect to the quality of democracy, in which the country first itself, and the Democratic Republic of Congo (DRC) is in their first years of democracy. Being the largest country in central Africa, in terms of population and density, still has a low Internet Users accessibility, and low internet penetration rate, explaining that changes in the social-technical regime are not an easy task, in order to do so, it requires a win of a niche-innovations win on the path of dependency and technological lock-in, whilst stabilising existing socio-technical regimes and past ones, which could determine its evolution.

This approach has proven useful for evaluating alternative technological innovations in the process of regime change. However, due to the limited understanding of niche-regime interactions, the pathways of regime change have only been identified as the process of innovation adoption. These key actors, institutions, and relationships have not been affected. From a macroscopic perspective, it is quite limited for the analysis by only using the transition management approach and little can be captured regarding the interaction between actors, technologies, and institutions.

Thus, further research findings on how innovations of Peer-to-Peer online lending are influenced by the development of regulatory regimes are to be undergone and the trajectory at which regulatory regimes' track of development are set out in Socio-Technical Transition also requires identification.

2.3.5 Existing Studies on the Regulation Regime and Regulation of Financial Innovation

According to Eisner (2000), Black (2001), and Vogel (2018), the regulatory regime definition is the combination of rules, enforcement, norms, and decision-making, considering a network of regulators as well as actors in the field.
Regulators in the Democratic Republic of Congo (DRC) have a lot to work on in terms of gathering peers to create groups dedicated to Fintech Regulation (New technology) to address the lack of regulatory reform framework and bills on.
These new financial innovation regulations necessitate flexibility and adaptability to maximise the full potential of innovations.

2.3.6 Niche to Regime

The Attention of the Congolese Central Bank and Central government regarding the regulatory regime of Peer-to-Peer lending was informally there, but formally not, and further development in that regard is highly required, as the regulatory framework has not been developed at the beginning of this phase. This revealed that the focus is not on technological financial innovations, of which the shift that could have been made from conventional prudential regulation towards being in the middle between prudential regulation and behavioural regulation, yet work is still in progress. The repercussion of not having a regulatory framework for this new segment of financial services is that the emphasis on behavioural regulation could not make the benefits, and the risks of consumers less valued. Therefore, the issues of default remain of concern for both lenders and Peer-to-Peer lending platforms.

2.4 Peer-to-Peer (P2P) lending

FinTech as its acronym stands for “Financial Technology” is the backbone in which Peer-to-Peer (P2P) lending lays its foundations as the rise and development in the online lending platform ecosystem.

2.4.1 Definition of Fintech

Kim et al. (2016) described FinTech as a financial service industry with industry changes enabled by mobile-centric information technologies that improve the efficiency of financial services. It has also been identified that financial services conduct in FinTech many services such as third-party payments, money market funds, insurance products, risk management, authentication, and Peer-to-Peer (P2P) lending.

2.4.2 Key Concepts of Financial Technology (FinTech)

The rapid development of information technology and the ubiquity of mobile devices are some of the reasons why the proliferation of FinTech is unmistakable in this new era of digitalization. Thus, the three aspects that characterize FinTech are Information processing, payment, and resource allocation. Therefore, having a financial system infrastructure in Central Africa, the Democratic Republic of Congo (DRC), will have a major impact on the adoption of Peer-to-Peer (P2P) lending and will positively influence financial activities via the internet to the extent with respect to convenience and security risks.

2.4.3 The Concept of Peer-to-Peer (P2P) lending

Among the key elements of FinTech in terms of services, Peer-to-Peer (P2P) lending is one of them. (Perez, 1988) noted that Peer-to-Peer (P2P) lending is indeed the radical innovation that galvanises the growth of the online lending market and the development of the Peer-to-Peer (P2P) lending sector and will implicitly lead to its regulatory regime shift, which would ultimately transform the lending market.

The rise of the idea of Peer-to-Peer lending can be referred back to microcredit principles, in the Democratic Republic of Congo (DRC), it is called “Banque Lambert” in its informal form for many years with high-interest rates, whereas the Peer-to-Peer online lending offers online loans to borrowers to lower costs compared to traditional banking institutions.

2.4.3.1 The Development and regulation of the Peer-to-Peer (P2P) lending industry

Most of the traditional financial institutions have tremendously changed their business models to fit in and meet the technological innovations’ demand as the emergence and development are unquestionably evident (Arner et al., 2015), and justified due to the high volume of individuals applying for capital flows, followed by manual administrative hassles that cannot be kept by traditional banks (Agarwal and Hauswald, 2008).

This is an opportunity that can translate into higher returns for lenders, while providing greater financial inclusion, comprehensiveness, and openness for borrowers in the Democratic Republic of Congo, only if the Central Bank of Congo engages in and defines a Peer-to-Peer lending regulatory framework, to minimise risk exposure from both lenders and borrowers when lending activities operate online, and de facto remain a major risk factor. The formal Peer-to-Peer lending platform was founded in 2020. Therefore, the Peer-to-Peer industry in the Democratic Republic of Congo (DRC) is in its infancy stage, and young for in-depth research.

2.5 Individual Lending Transition

Peer-to-Peer (P2P) lending already existed for a decade in the Democratic Republic of Congo not online and also informal. However, the financial technology brought the emergence and development of Peer-to-Peer lending to another level impacted the lending behaviours of each individual borrower and lender, thus enabling a smooth transition of individual lending sectors.

The world bank report shows that 1.7 billion adults are not able to reach banking services across the globe. Peer-to-Peer (P2P) lending provides alternative finance loan access opportunities to meet the high demand of untapped borrowers with little or without a credit history.

The potential risks have become inevitable, and the emphasis has increasingly been placed on the regulatory side of this new field in the financial service industry (e.g Slattery, 2013; Marvin, 2017)

Thus, this sufficiently proves from a transition perspective the positive impact of Peer-to-Peer (P2P) lending vis a vis the existing and traditional lending systems in place and also confirms that the process of interactions between Peer-to-Peer (P2P) lending and regulatory regime remain unexplored and unexploited.

2.5.1 Pre-development phase:

With the increase growth of information technology and mobile devices, there is more pressures and challenges that tradition financial institutions face from radical innovations in the sector.

2.5.2 Take-off phase:

In the case of Congolese individual lending transition, this phase is yet to be discovered, given that Peer-to-Peer lending platforms in DR. Congo is in an infancy stage as well as Where the existing regime begins to change due to the impact of financial innovation. As shown in Appendix

2.5.3 Stabilisation phase

According to (Rotmans et al, 2001; Kemp 2007 and Geels) at the stabilisation phase Peer-to-Peer lending had reached and experienced a long period time of accumulation, establishment and market expansion. At same experiencing development slowdown in social change and final achieving dynamic stability. As shown in Appendix

2.6 Analytical Framework

2.6.1 Multi-Level Framework for Individual Lending Transition

The Multi-Level Framework has been presented as an experimentation analytical framework for Socio-Technical Transition. Moreover, it considers a transition as a dynamic process and concentrates on the interaction of niche innovations, socio-technical regimes, and landscape development.
According to Geels (2004), the socio-technical regime is congruent and aligned with other regimes such as the technology and policy regimes.
The Multi-Level Perspective Framework presents a Global Model, which is an outside-in model that describes the overall trajectories, paths, phases of an innovation's development and the influence of the innovation from a long-term macro perspective versus a Local Model (micro short-term perspective).
The regulatory regime has identified the three-level framework (Landscape, Regime and Niche) and the multi-level framework for individual lending transition, including policy paradigms, visions, norms and beliefs of governmental authorities.
Thus, the sub-research question of "What are the trajectories of Peer-to-Peer (P2P) lending and the regulatory regime in the case of Individual Lending Transition Congolese in the Democratic Republic of Congo (DRC)" (SubRQ1) can be addressed and identified.

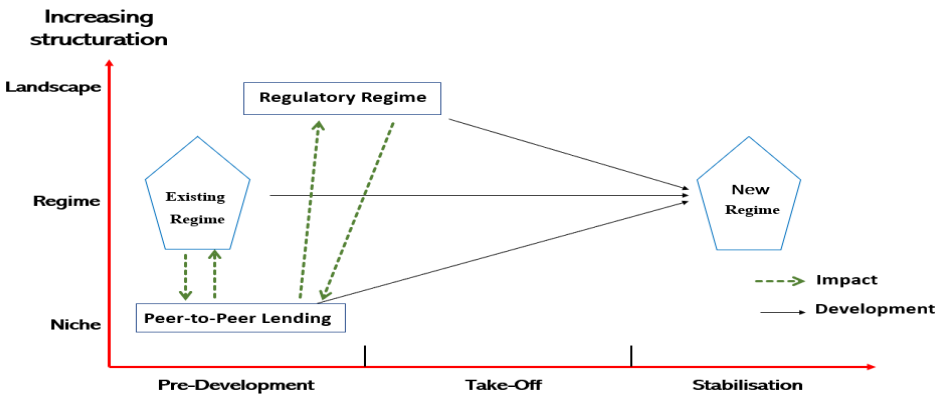


Fig 2: The Multi-Level Perspective Framework for Individual Lending Transition (Global Model)

2.6.2 A local Model for Institutional Analysis

The Local Model as an outside-in model gives a rationale for the ideas, decisions, actions and events of the developmental processes from a micro level, short-term perspective. Hence, both macroscopic transition processes and microscopic regulator and actor activities. However, the three-level of Multi-Level Perspective has been validated as a global model which demonstrates at considerable length Socio-Technical Transition processes (Geels and Schot, 2007) and on the other hand, the Local Model of Multi-Level

Perspective explains how different regulators and actors influence each other stayed put in underdeveloped (Fuenfschilling and Truffer, 2014; Geels, 2019).

In addition, in order toubRQ2 (How do Peer-to-Peer (P2P) lending and the regulatory regime influence each other in the process of Congolese Individual lending transition), SubRQ3 (What is the generalised trajectory of the regulatory regime in Socio-Technical Transition), SubRQ4 (How is the coordination of the impact of Peer-to-Peer (P2P) lending adoption and regulatory regime promoted in Socio-Technical Transition), the introduction of a Local Model is of necessity, as it offers a better understanding of the interactions between innovation and regulatory regime in transition processes. Furthermore, to get a grasp of the two-way-direction patterns of the interactions between Peer-to-Peer lending and the regulatory regime, however, it is important to understand the concept of the organisational field from institutional theory which has been adopted (McAdam and Scott, 2005) and useful to set out the interrelationships between actors in

the sector. Consequently, Congolese actors make efforts to shape the institutions to favour their interests and vice versa in terms of improvement and change. Thus, as a result, the acknowledgement by the institutions to have a close relationship, and bond of interactions between/with actors in the sector is undeniable.

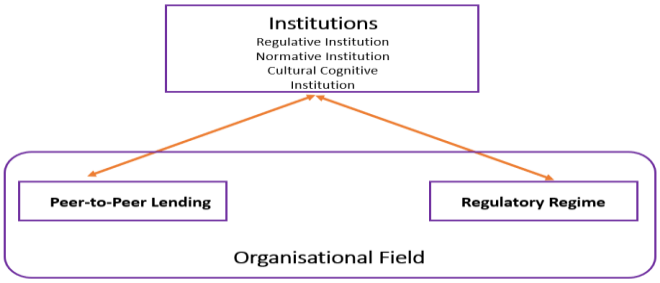


Fig 3: The Local model for institutional analysis

2.7 The Trajectory of the Individual Lending Transition

Once the integration of the trajectories of Peer-to-Peer lending and the regulatory regime and adapting the trajectories into the individual lending transition framework in section

Table 1.1 key events in the Pre-development phase and their significance

Key Events	Time	Significance					
		Process-Oriented Dimension			Perception-Oriented Dimension		
		Niche	Regime	Landscape	Regulative	Normative	Cultural cognitive
Issue of decree MygoldRev Operation shutdown [2020] by the Central	2020		Restricted online lending platforms the use of Cryptocurrencies		Online business and Peer-to-Peer lending platforms must	The reputation of online business was significantly damaged	Peer-to-Peer lending is regarded as untrustworthy, considered a negative factor that has a

Bank of Congo					comply with the Central Bank of Congo		direct influence on social stability for some time

Soft credit information is highly valued in most parts of Africa, in the Democratic Republic of Congo (DRC) in particular, is influenced by traditional Congolese culture, and trust is the most vital factor for lenders in Congolese Peer-to-Peer lending businesses.

The trajectories of Peer-to-Peer lending and the regulatory regime have indisputably been identified, as organisational field actors, so any institution change has also an influence on field actors. The organisational field is the arena where all social activities are carried out by diverse actors, and the analysis of its development considers only similar organisation field actors, which includes traditional individual lending, Peer-to-Peer lending as well as the regulatory regime for Peer-to-Peer (P2P) lending. The Democratic Republic of Congo (DRC) regulatory regime has been disrupted for many years due to unstable institutions on a political level in some parts of the country which slow the regulative process level.

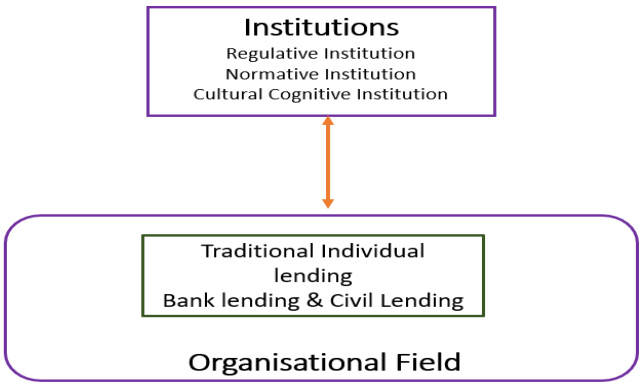


Fig 4: The Original organisational field before transition initiation. The organisational field in the pre-development phase and after transition initiation

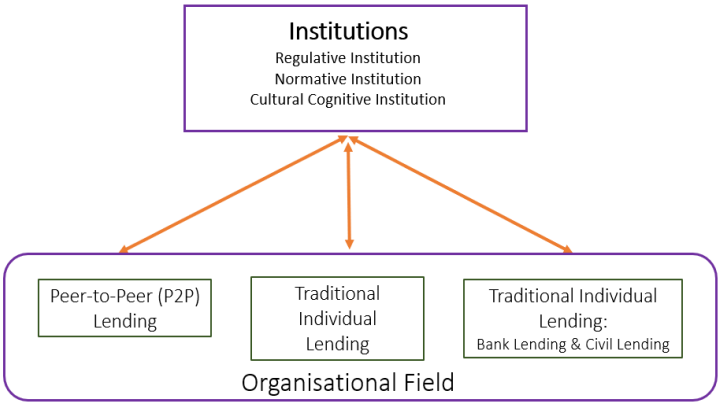


Fig5: the organisational field from the take-off stage

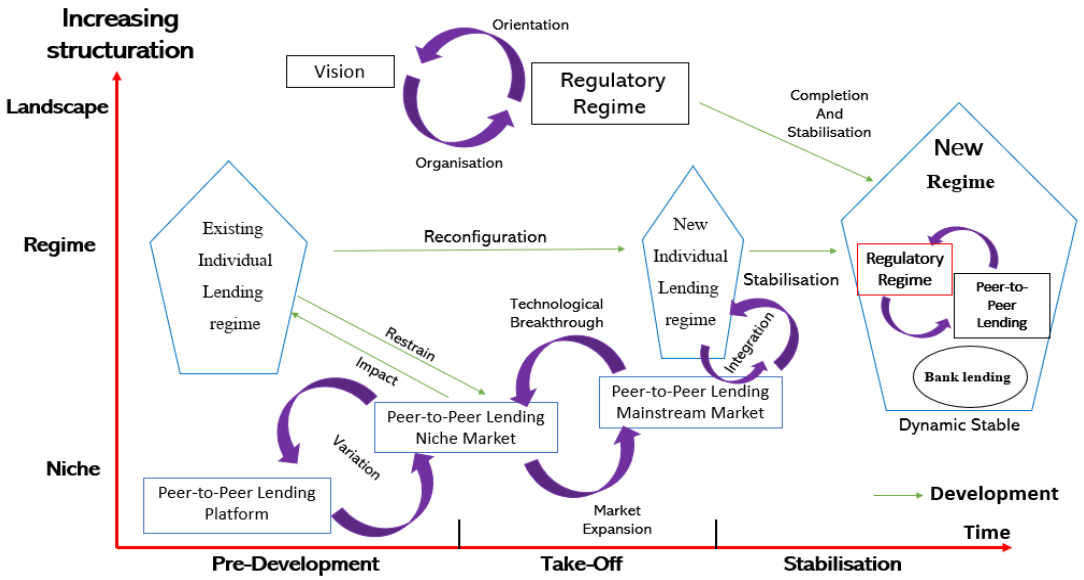


Fig6:Three development phases (regulatory regime)

2.8 Research Design

It is largely accepted that the case study method is suitable for research: which takes on "How" and "Why" that emphasizes the modern or ongoing phenomena, where the examiner/investigator has no control over event behavioural factors.

This research answers the research question of "How does the impact of the adoption of Peer-to-Peer lending and the regulatory regime unfold in Socio-Technical Transition" Central Africa, in the Democratic of Congo (DRC) and thoroughly explores the Individual Lending Transition in the case of Congolese.

While the transition process is taking, the author has no control of any behavioural events, for there is no need to do so, as it is a paradigm shift in the social-technical regime, which has been caused by the unexpected impact of niche-innovation development and pressure coming from landscape side. Thus, the case study method was accepted and taken into consideration in agreement with the suggestions of Yin (2017)

In addition, both primary and secondary were collected for this research. The primary data was collected from semi-structured interviews and the secondary data which includes documents, policy, news, and reports collected using digital channels via the internet.

2.8.1 Research Method

Open-source websites:

Organization for Economic Co-operation Development - www.oecd.com
World Bank - www.worldbank.com
Central Bank of Congo - https://www.bcc.cd/com
Minister of Digital in the Dem. Republic of Congo - https://numerique.gouv.cd/
Africa internet penetration - https://www.statista.com/
Africa Open Data - https://africaopendata.org/

Peer-to-Peer lending platforms operate solely online and understanding the level of the internet accessibility, internet users, and internet connectivity per home, density, population and countries in Central Africa that share borders with the Democratic Republic of Congo DRC were of great importance to conducting predictive and prescriptive analytics. Machine learning Models, techniques and Blockchain (Smart Contract Peer-to-Peer lending) are used in this report, to predict Internet user connectivity across the Democratic Republic of Congo and its nine neighbouring countries
Data was collected from the following open-source websites:

- OECD: Organisation for Economic Co-operation and Development
- World Bank
- Africa Open data
- Africa Statista

To Access Research Project Predictive Analytics Models for R Studio Cloud
Click here!
RStudio Cloud

To access Python Google Colab Research Project Predictive Analytics Models
Click here
https://colab.research.google.com/drive/1A8NTydYTC4LMoTN9yS3JmLaekrzhnrpi?usp=sharing

In total, the dataset comprises 10 observations and 28 variables, only 10 observations and 11 were retained to build an acceptable accurate predictive model

II. SECTION 2: MACHINE LEARNING

Machine learning Models and techniques used are as follows:

The link to R Studio Cloud

RStudio Cloud

In this research project, we used five modelling techniques to predict the model as follows

1. R STUDIO CLOUD

Evaluation & Results: Comparison between 5 models

This research project focuses on the impact of the adoption of Peer-to-Peer (P2P) online lending platforms in the socio-technical transition in the case of Congolese individual lending transition in the DR Congo.

Peer-to-Peer lending businesses core operation and business model is the execution of their models online, that differentiate them from the traditional lending institutions.

Therefore, it is imperative to understand the User connectivity or penetration rate in the region, to hear understanding of regulatory regime, the connectivity per user, Internet per household and also the mobile data prices to have a longer internet time spent, which could enable the user to access funds and services via the online lending marketing strategies to attract those prospective borrower

The prediction model variance score conducted on Python Google Colab are shown below

Table 1.2 : P2P lending dataset – Evaluation and comparison of 5 models

	R-Square	MAE	MSE	RMSE
XGBoost	73.84%	2.80	7.91	2.81
Random Forest	57.05%	3.28	14.48	3.80
KNN	-0.22%	5.21	30.31	5.50
SVM	-0.22%	5.21	30.31	5.50
Linear Regression	-872.62	116.19	26427.05	162.56

Fig7: Models vs R square and Errors Metrics

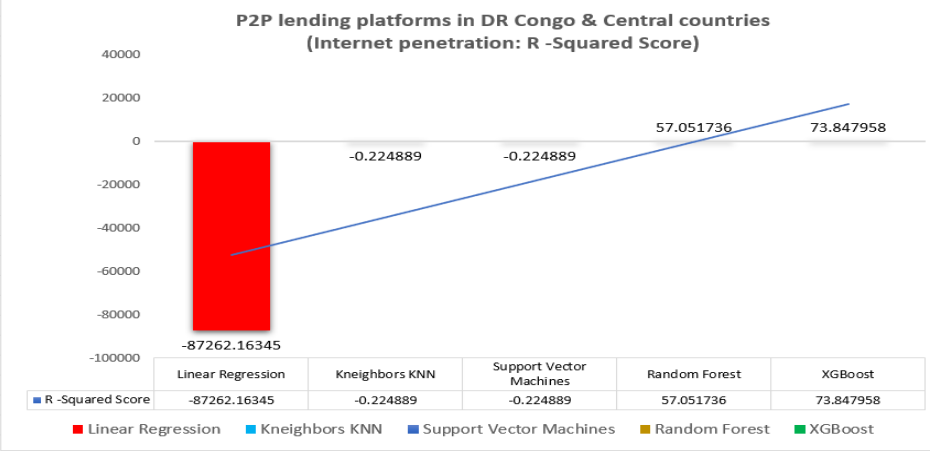


Fig8: Internet users in DR Congo and Central African countries

a. Exploratory Data Analysis (EDA) in R Studio Cloud

The well-fitted modelling technique was XGBoost with a R squared of 73.84%, followed by Random Forest 57.05% using regression Model Python Google Collab, and the independent variable was Internet _Users, meaning internet per user.
Surprisingly the Linear regression with a staggering variance of score of -87262.16, KNN, SVM have underperformed,
Now we want to build a prediction linear regression in R Studio, assess the result and recommendations if possible.

Pre-processing dataset (Excel)

CENTRAL AFRICA - DEMOCRATIC REPUBLIC OF CONGO (DRC) NEIGHBOURING COUNTRIES

EXCEL DATASET FOR PREDICTIVE& PRESCRIPTIVE ANALYTICS: PEER-TO-PEER LENDING PLATFORMS IN THE DR CONGO

CountryName	CountryCode	Population_2019	ıpulation_20	HDI_2020	Population_2021	Population_2022	HDI_2022	Growth	Density	ernet_Usme_intertive_Mobndiv_internebile_datapri					Ev_regulation
Angola	AGO	31825299	32866268	0.574	33933611	35027343	0.574	1.0322	28.096	36	11	21	14	2	G2
Burundi	BDI	11530577	11890781	0.433	12255429	1262484	0.423	1.0301	453.5762	15	0	11	3	1.5	G3
Central African Republic	CAF	4745179	4829764	0.394	4919987	5016678	0.381	1.0197	8.0527	7	3	5	4	1.8	G2
Congo, Dem. Rep.	COD	86790568	89561404	0.48	92377986	95240792	0.459	1.031	40.6169	18	1	20	9	5	G3
Congo, Rep.	COG	5380504	5518092	0.571	5657017	5789559	0.574	1.0249	16.9526	25	3	6	9	2	G3
Rwanda	RWA	12626938	12952209	0.539	13276517	13600464	0.536	1.0244	516.3818	26	9	42	22	2	G3
South Sudan	SSD	11062114	11193729	0.398	11381377	11618511	0.413	1.0208	18.7472	11	4	6	8	2	G2
Tanzania	TZA	58005461	59734213	0.528	61498438	6329855	0.528	1.0293	66.9764	25	14	10	16	2	G4
Uganda	UGA	44269587	45741000	0.543	47123533	48432863	0.528	1.0278	200.5086	29	11	34	24	2	G2
Zambia	ZMB	17861034	18383956	0.583	18920657	19470234	0.591	1.029	25.8702	29	18	51	14	1.5	G4

Fig9: Central African Countries: Democratic Republic of Congo (DRC) neighbouring countries

The dataset csv file is import into R studio Cloud

```
setwd("/cloud/project")
AfriData<- read.csv("Central_Africas1.csv")
AfriData
```

Fig: import CSV file from desktop to R cloud

```
> str(AfriData)
'data.frame':   10 obs. of  27 variables:
 $ CountryName      : chr  "Angola" "Burundi" "Central African Republic" "Congo, Dem. Rep." ...
 $ CountryCode      : chr  "AGO" "BDI" "CAF" "COD" ...
 $ SeriesName       : chr  "Population, total" "Population, total" "Population, total" "Population, total" ...
 $ SeriesCode       : chr  "SP.POP.TOTL" "SP.POP.TOTL" "SP.POP.TOTL" "SP.POP.TOTL" ...
 $ YR_1990          : int  11848385 5438959 2806740 34612023 2356740 7288883 5492620 25203848 17354395 8036849
 $ Yr_2000          : int  16395477 6378871 3640421 47105830 3127420 7933688 6199396 33499177 23650159 10415942
 $ Yr_2012          : int  25107925 9245992 4436411 69020749 4510197 10549668 10113648 47053033 34558700 14465148
 $ Yr_2013          : int  26015786 9540302 4447945 71358804 4622757 10811538 10355030 48483132 35694519 14926551
 $ Yr_2014          : int  26941773 9844301 4464171 73767445 4736965 11083629 10554882 49960563 36911530 15399793
 $ YR_2015          : int  27884380 10160034 4493171 76244532 4856093 11369066 10715657 51482638 38225447 15879370
 $ Yr_2016          : int  28842482 10488002 4537683 78789130 4980996 11668829 10832520 53049231 39649173 16363449
 $ YR_2017          : int  29816769 10827010 4596023 81398765 5110701 11980960 10910774 54660345 41166588 16853608
 $ YR_2018          : int  30809787 11175379 4666375 84068092 5244363 12301969 10975924 56313444 42729032 17351714
 $ Population_2019  : int  31825299 11530577 4745179 86790568 5380504 12626938 11062114 58005461 44269587 17861034
 $ Population_2020  : int  32866268 11890781 4829764 89561404 5518092 12952209 11193729 59734213 45741000 18383956
 $ HDI_2020         : num  0.574 0.433 0.394 0.48 0.571 0.539 0.398 0.528 0.543 0.583
 $ Population_2021  : int  33933611 12255429 4919087 92377986 5657017 13276517 11381377 61498438 47123533 18920657
 $ Population_2022  : int  35027343 1262484 5016678 95240792 5789559 13600464 11618511 6329855 48432863 19470234
 $ HDI_2022         : num  0.574 0.423 0.381 0.459 0.574 0.536 0.413 0.528 0.528 0.591
 $ Growth           : num  1.03 1.03 1.02 1.03 1.02 ...
 $ Density          : num  28.1 453.58 8.05 40.62 16.95 ...
 $ Internet_Users   : int  36 15 7 18 25 26 11 25 29 29
 $ Home_internet    : int  11 0 3 1 3 9 4 14 11 18
 $ Active_Mobile    : int  21 11 5 20 6 42 6 10 34 51
 $ Indiv_internet   : int  14 3 4 9 9 22 8 16 24 14
 $ Mobile_dataprices: num  2 1.5 1.8 5 2 2 2 2 2 1.5
 $ Ev_regulation    : chr  "G2" "G3" "G2" "G3" ...
>
```

Figure10: Dataset and datatype visualization using R Desktop and R Studio Cloud

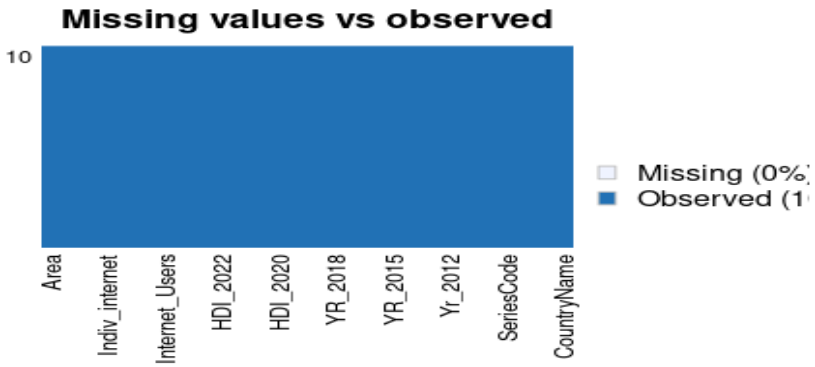


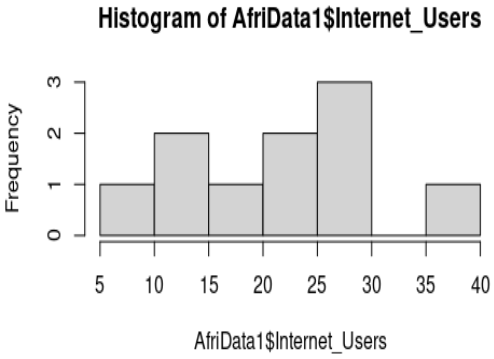
Fig11: Missing values vs observed Check

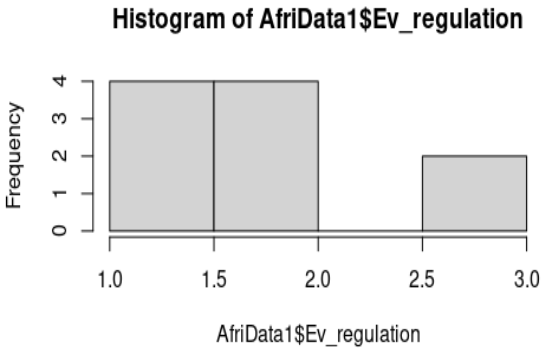
```
$ Population_2022  : int  35027343 1262484 5016678 95240792 57
511 6329855 48432863 19470234
$ HDI_2022         : num  0.574 0.423 0.381 0.459 0.574 0.536
.591
$ Growth           : num  1.03 1.03 1.02 1.03 1.02 ...
$ Density          : num  28.1 453.58 8.05 40.62 16.95 ...
$ Internet_Users   : int  36 15 7 18 25 26 11 25 29 29
$ Home_internet    : int  11 0 3 1 3 9 4 14 11 18
$ Active_Mobile    : int  21 11 5 20 6 42 6 10 34 51
$ Indiv_internet   : int  14 3 4 9 9 22 8 16 24 14
$ Mobile_dataprices: num  2 1.5 1.8 5 2 2 2 2 2 1.5
$ Ev_regulation    : chr  "G2" "G3" "G2" "G3" ...
$ Area             : int  1246700 27834 622984 2344858 342000
41550 752612
```

Fig12: Visualising datatypes

```
#converting NA to 0
AfriData[is.na(AfriData)] <- 0
```

Fig13: NAs values are converted to zero






```
> jarqueberaTest(multi.fit$resid)

Title:
 Jarque - Bera Normalality Test

Test Results:
  STATISTIC:
    X-squared: 0.249
  P VALUE:
    Asymptotic p Value: 0.8829

Description:
 Sat Aug 13 20:35:21 2022 by user:

>
```

Fig14: The jarquebera test cheks if the skwness and kurtosis of the residuals are similar to that of a Normal distribution

```
> dwtest(multi.fit)

        Durbin-Watson test

data:  multi.fit
DW = 2.1689, p-value < 2.2e-16
alternative hypothesis: true autocorrelation is greater than 0
```

Fig15: Durbin Watson test used in Time-series to test if there is a trend in the data based on previous data point, and that DW and that DW autocorrelation is greater than 0, p-value above 0.05

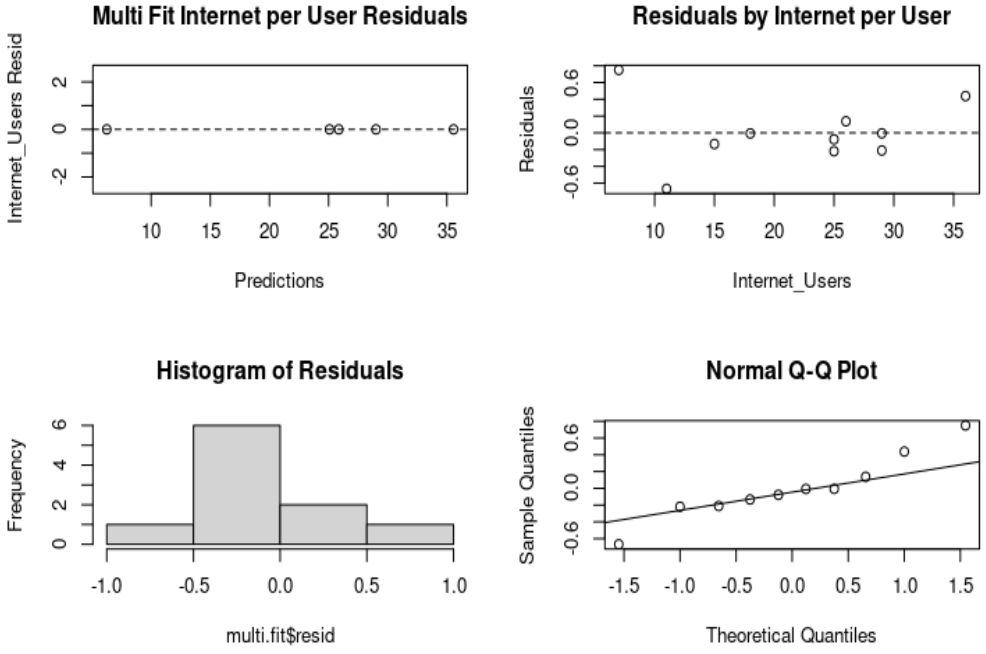


Fig16: Multi-linear regression using the independent variable Internet_Users

```
Coefficients:
                  Estimate Std. Error t value Pr(>|t|)
(Intercept)     -1.958e+03  3.067e+02  -6.384   0.0989 .
Population_2020 -3.356e-07  8.180e-08  -4.103   0.1522
HDI_2020         1.788e+01  1.623e+01   1.101   0.4693
Active_Mobile   -1.822e-01  6.984e-02  -2.609   0.2330
Growth           1.908e+03  3.033e+02   6.290   0.1004
Density         -1.020e-02  4.274e-03  -2.387   0.2526
Mobile_dataprices  4.839e+00  1.951e+00   2.480   0.2440
Home_internet    3.707e-01  2.706e-01   1.370   0.4014
Indiv_internet   1.084e+00  1.813e-01   5.979   0.1055
---
Signif. codes:
0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.156 on 1 degrees of freedom
Multiple R-squared:  0.9982,    Adjusted R-squared:  0.9837
F-statistic: 69.01 on 8 and 1 DF,  p-value: 0.09284
```

Fig17: Linear regression Prediction Model using the target variable internet_users

The result of the linear regression model predicted has an accuracy 99% and p-value above 0.09 mean above 0.05 ~ 5% it exhibits a well fitted model, the variable high correlated with Internet per user is Mobile dataprices with an estimate coefficient of 4.839, which again shows how ubiquitous Internet is, that people are willing to pay more for less Gigabytes in central Africa, DR Congo in particular with the highest mobile data prices in the region.
In Google Colab, we have performed a combination of multiple techniques in our case we used 5 modelling techniques, that could be one of the arguments having the lowest R-squared in comparison to other techniques used.

Furthermore, as Peer-to-Peer lending platforms are facing regulatory dilemma, as part of our research to predict the Regulatory Evaluation in the region, the variable Ev_regulation was encoded from categorical to numerical. See (Fig) in order to further our prediction model and assess the outcome variance score (R-Squared)

```
fit1 <- lm(AfriData1$Internet_Users~AfriData1$Ev_regulation)
fit1
summary(fit1)
plot(fit1)
```

Fig18: A straight fitting linear regression to determine the correlation/relationship between the two variables

```
Call:
lm(formula = AfriData1$Internet_Users ~ AfriData1$Ev_regulation)

Residuals:
    Min      1Q  Median      3Q     Max
-12.929  -6.893   1.000   3.571  16.071

Coefficients:
                       Estimate Std. Error t value Pr(>|t|)
(Intercept)              17.214      7.693   2.238   0.0556 .
AfriData1$Ev_regulation   2.714      3.946   0.688   0.5110
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 9.338 on 8 degrees of freedom
Multiple R-squared:  0.05584,   Adjusted R-squared:  -0.06218
F-statistic: 0.4731 on 1 and 8 DF,  p-value: 0.511
```

Fig19: Single Linear Regression prediction

b. Conclusion (Linear Regression in R)

The linear regression between the Internet per User and the Regulation categorised per DR. Congo neighbouring countries, clearly shows a variance score or R-Squared of 0.05 or 5% , not even close to mean or acceptable 60% of the score.
This explains the latency in dealing with high-level matters in this case, the rise of Peer-to-Peer lending that neither central government nor Central Bank in DR. Congo have a clear regulatory framework in place. The impact of the adoption of Peer-to-Peer lending by the regulatory regime needs to be addressed rather than the cultural cognitive orientation [7, onlineNews6]

2. PYTHON (GOOGLE COLLABORATORY)

a. Exploratory Data Analysis

b.

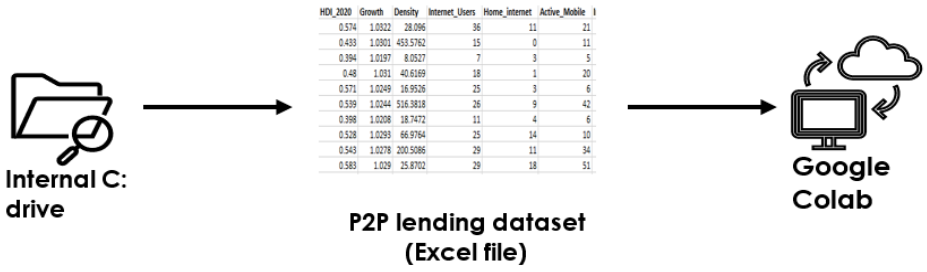


Fig20: P2P lending dataset import- implementation

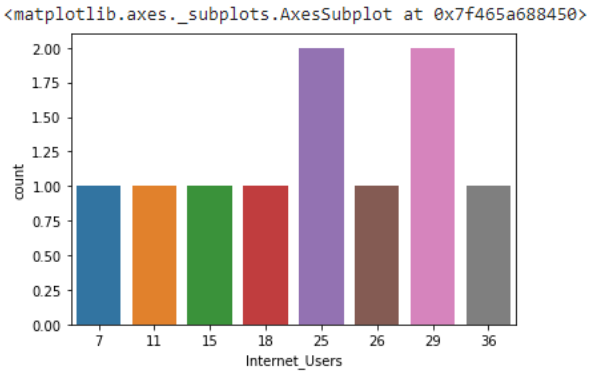
Dataset variables 10 Observations and 10 variables
Pre – processing we dropped 17 make non intuitive sense and remains with 11 variables
Target/Independent variable: Internet_Users

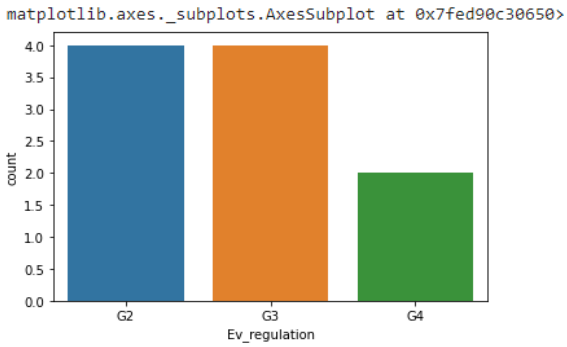
```
# Loading the csv file /read the csv file
Data = pd.read_csv('Central_Africas1.csv')
df = pd.DataFrame(Data)
print(df)
```

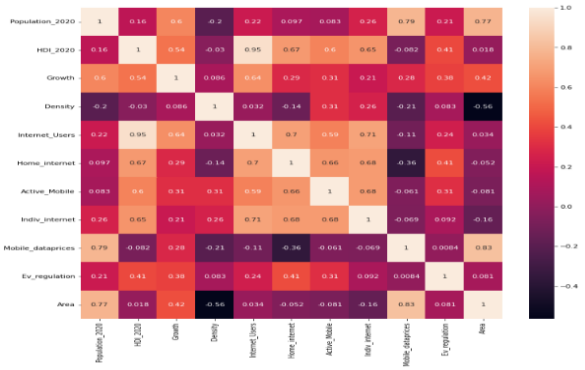
Fig21: Import dataset csv rawData

The technique used is the Regression Modelling techniques of the following:

- ✓ Random Forest (RF), Linear Regression, XGBoost (XGB), Support Vector Machine (SVM), K-Nearest Neighbors (KNN)







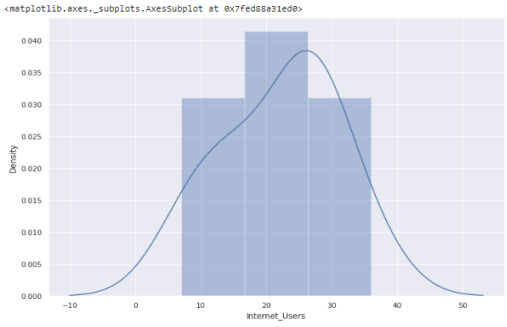


Fig22: Correlation between variables

Fig23: Mean distribution average 25

	sum_sq	df	F	PR(>F)
Ev_regulation	0.061444	1.0	0.000614	0.981783
Home_internet	20.631337	1.0	0.206268	0.680553
Population_2020	0.522798	1.0	0.005227	0.946916
Active_Mobile	0.833920	1.0	0.008337	0.933002
Indiv_internet	37.047809	1.0	0.370397	0.585775
Mobile_dataprices	0.000326	1.0	0.000003	0.998674
Residual	300.065451	3.0	NaN	NaN

Fig24:ANOVA statistic Table

The Peer-to-Peer (P2P) lending model was checkpointed, created a Neural network Model, 19 nueron were selected, based on the number of features, Each Epoch took less than 5 minutes to run on Google Colab, which was successful validating the train set and test set, epochs=400, but the Neural network Model variance score is -1167, and proceeded with Keras regression model variance score: -116753. As shown in Fig

```
Mean Absolute Error: 188.01
Mean Squared Error: 36290.58
Root Mean Squared Error: 190.50
Variance score is: -1167.54
```

Fig25: Neural Network train score

```
Model: Keras Regression

Mean Absolute Error(MAE): 188.01
Mean Squared Error(MSE): 36290.58
Root Mean Squared Error(RMSE): 190.50
Variance score: -116753.51

**********************************

Model: Multiple Linear Regression
```

Fig26: Keras Linear Regression

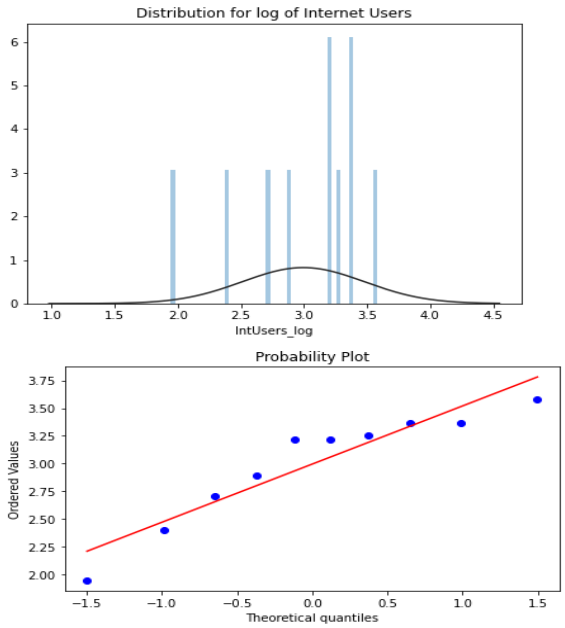


Fig 27: Distribution for log/independent variable Internet_Users

P2P LENDNG DATASET - EVALUATION AND COMPARISON OF 5 MODELS

Target/ independent variable : **INTERNET USERS**

```
models = pd.DataFrame({
    'Model': ['Linear Regression', 'KNeighbors KNN', 'Random Forest', 'Support Vector Machines', 'XGBoost'],
    'R-squared Score': [acc_linreg*100, acc_knn*100, acc_rf*100, acc_svm*100, acc_xgb*100,]})
models.sort_values(by='R-squared Score', ascending=True)
```

	Model	R-squared Score
0	Linear Regression	-87262.163445
1	KNeighbors KNN	-0.224889
3	Support Vector Machines	-0.224889
2	Random Forest	52.121322
4	XGBoost	73.847958

Fig28: Evaluation and Results of 5 predictive models

b. Conclusion: Python Google Colab

Normally, the variance score prediction is low when you combine several models, however, in this case, XGBoost was well fitted with a variance score of 73.81% and a low R Mean Square Errors RMSE of 28 per cent (%), followed by Random Forest that has performed in the range of the mean around 57%. See in Fig()
The XGBoost outperformance in variance scoring is justified in its accuracy rate at that range 70% due the combination of all the models and also variables such as Home_Internet (internet per house) et (indiv_internet per individual) that have high co-efficient among other variables.
This tells us that Central African people do not mind paying high Gigabytes to top up their phones as long as they have internet connectivity that keep them in touch with family and friends also social media networks.

The reason why we conducted a linear regression prediction in R, is outcome prediction variance score (R Squared) -87262.16 while running Neural Network (run 300 epochs and Keras regression. The underperforming modelling techniques are KNN, SVM, Linear Regression, To dig deeper into cause, in R we use Multi regression with a variance score of 99% and found the LM prediction unrealistic based on the dataset inputs and also the secondary research conducted (Interviews) during the research project investigative process, a need of regulatory framework in the Peer-to-Peer lending is required but the central government, policymakers are lagging behind the financial technological innovation
Thus, further investigation and studies need to be examined and addressed

III. SECTION 3

BLOCKCHAIN TECHNOLOGY – SMART CONTRACTS

The rapid growth of Peer-to-Peer lending in Western and Eastern Africa, has led other countries to follow suit and Central African countries such as DR. Congo, where unbanked rate exceeding 70 per cent and this represents an opportunity for Peer-to-Peer lending platforms to explore in terms of Customer acquisition.

1. What is blockchain?

Blockchain is defined as a distributed shared ledger that consists of blocks supporting the recording of transactions between both lenders and borrowers. Those blocks are immutable, unchangeable, as they are cryptographically chained and sealed.

2. Decentralised Peer-to-Peer lending platforms

Peer-to-Peer online lending platforms are decentralised types of credit service which joins and brings both parties borrowers and lenders together, facilitates borrowers to access funds or loans from lenders/investors directly without intermediaries. The borrower must sign up with the platform and make a loan request directly to investors/lenders. The business model of Peer-to-Peer online platforms have been widely accepted by the mainstream

3. Benefits of Peer-to Peer lending platform using Blockchain Technology

Peer-to-Peer lending platforms differ from the traditional financial institutions, as they do not secure loans with a collateral, neither loan is not backed up by a collateral, offer low interest rates, flexible and easy loan application, Collateral is not secured the KYC (Key Your Customer) validation system effectively auto-generated interest rate based on the prospective borrowers' profile.

4. Risks and Threats of Peer-to-Peer lending platform

The risky aspects that FinTech in general, and Peer-to-Peer lending encounter are trust, traceability of transactions , which are addressed strongly by blockchain technology

In this section, a Peer-to-Peer online lending blockchain Smart contract running on blockchain Ethereum Technology to facilitate borrower to access loans once criteria set out by the online platform are met

5. Blockchain Smart Contracts

Smart contract is the key driver of blockchain, which executes automatically when terms and conditions required are met. It carries out execution and enforces the agreement made between both untrusted parties.(Q. Yang et al). See in (Fig)

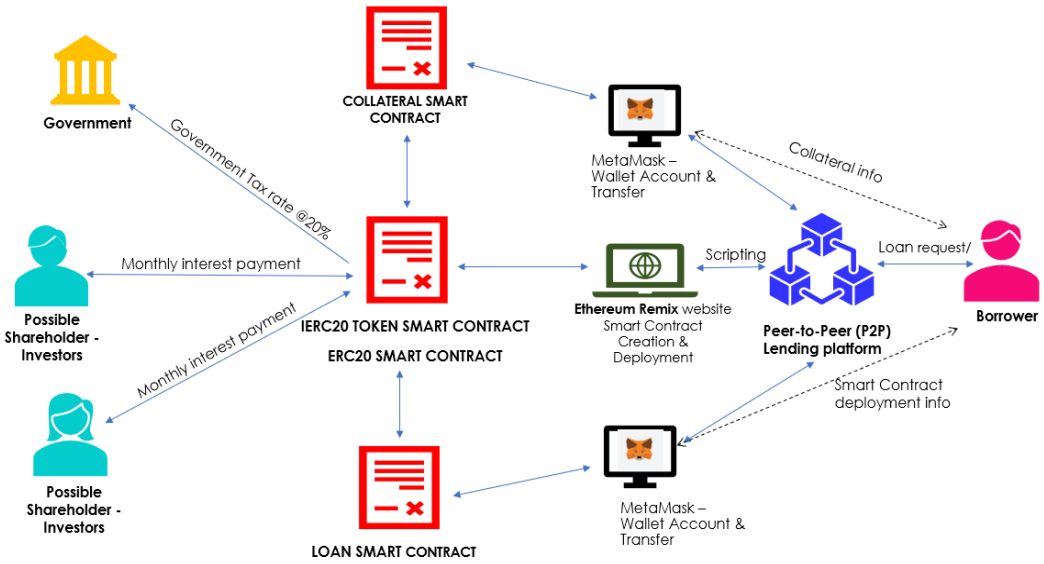


Fig29: Utilisation of Blockchain smart contract deployment & transactions

6. MetaMask

MetaMask is a website software that specifically runs cryptocurrencies, enables interactions with Cryptocurrencies such as Ethereum, facilitating smart contract deployment, allowing the user/borrower to access his/her wallet account information. (Fig)

(Fig30): MetaMask logo

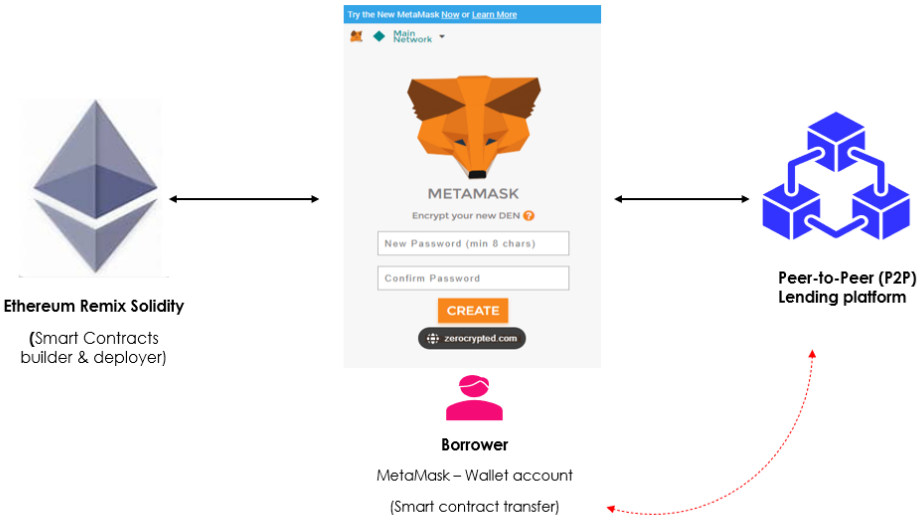


Fig31: High-level Ethereum Solidity Remix – MetaMask – P2P Lending

7. Smart Contracts Utilisation

This research project proposes the utilisation of collateral to reinforce Peer-to-Peer online platforms more secure.
Some of the blockchain processes are the use of Public blockchain to authenticate (KYC verification) of the borrower. Moreover, a private and permissioned blockchain enables storage set up of information the borrower and lender's information recorded in secured blocks

There three elements use to create the blockchain smart contract are as follows:

1) **Collateral management**
   This type of smart contract generates a token, that will be exchanged with the borrower's crypto assets submitted as collateral, which has a higher value or equivalent to the loan amount requested.
2) **Loan management**
   Similar to any loan contract that contains terms and conditions. It is deployed as for managing loan, fixing the terms of rate of interest, and transfer the loan funds from lender to borrower, and execute the monthly interest payments as agreed.
   In case the borrower default on a loan payment, the online lending platform repossesses the borrower's collateral, and proceed with the compensatory process.
3) **Compensation management**
   Once the borrower defaults on a loan payment, the compensation management smart contract kicks in to disperse compensatory funds to the concerned lenders whose payments are due to be paid in full.

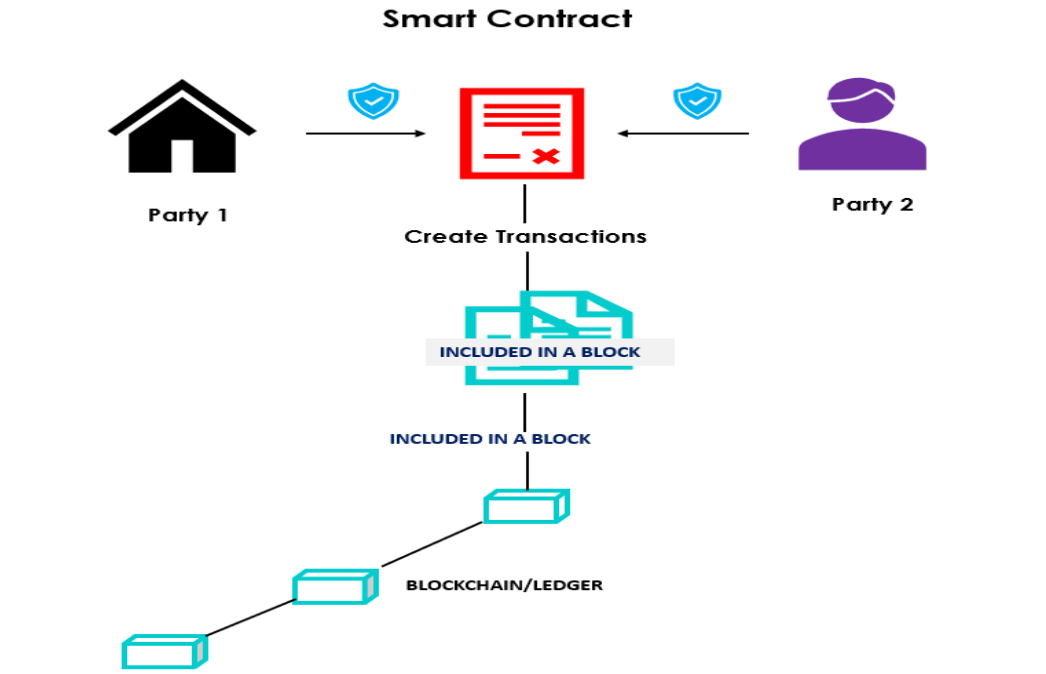


Fig31: Blockchain &Smart Contract flow

This research project deploys IERC20Token combined with the standard ERC20, collateral smart contract and loan smart contract and in case of default, the loan smart contract repossess function will be executed and the collateral will be seized and repossessed

```
    require(token.transfer(borrower, collateralAmount));
    emit LoanPaid();
    selfdestruct(lender);
}

function repossess() public {
    require(now > dueDate);

    require(token.transfer(lender, collateralAmount));
    selfdestruct(lender);
}
```

Fig32: loan smart contract repossesses function (Solidity Ethereum Remix platform

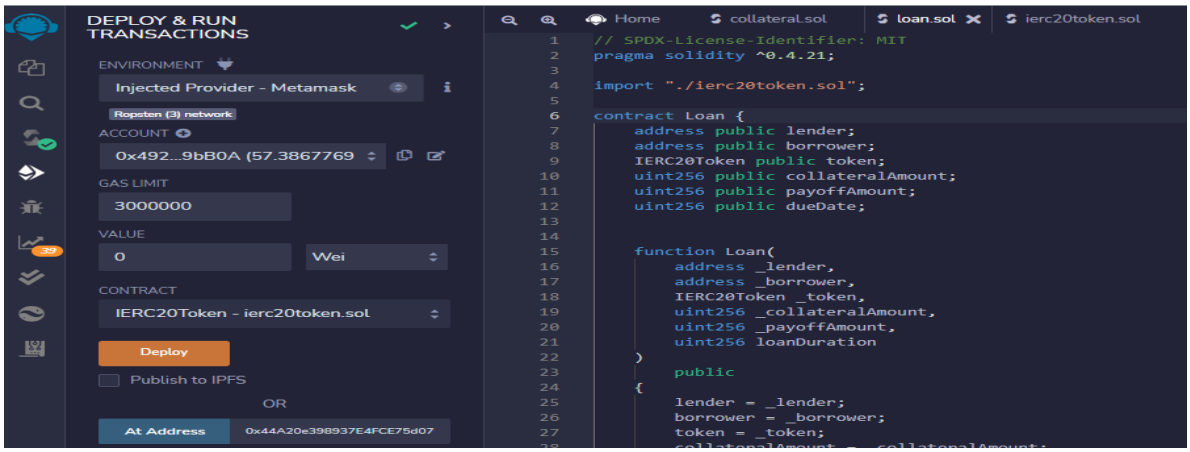


Fig33: loan smart contract JavaScript creation and deployment

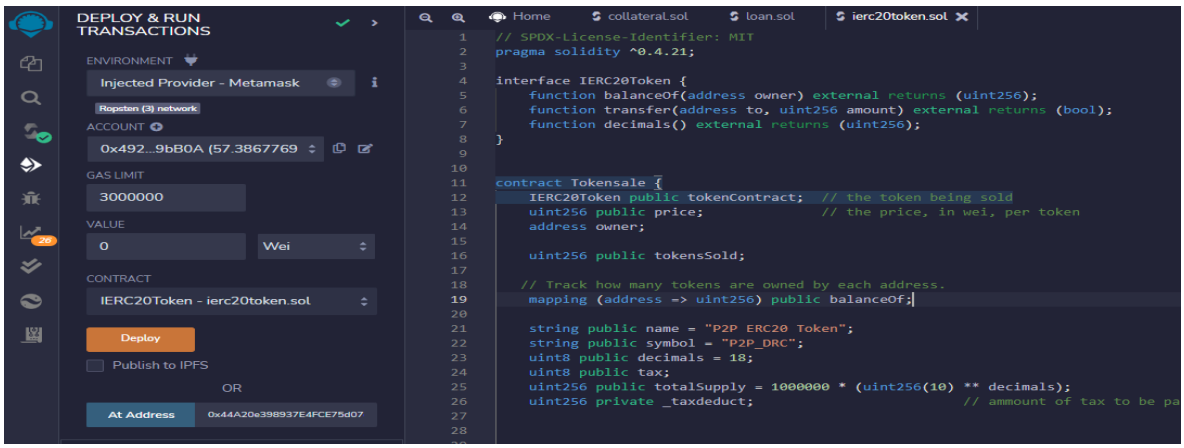


Fig34: IERC20Token smart contract developed and ready for deployment

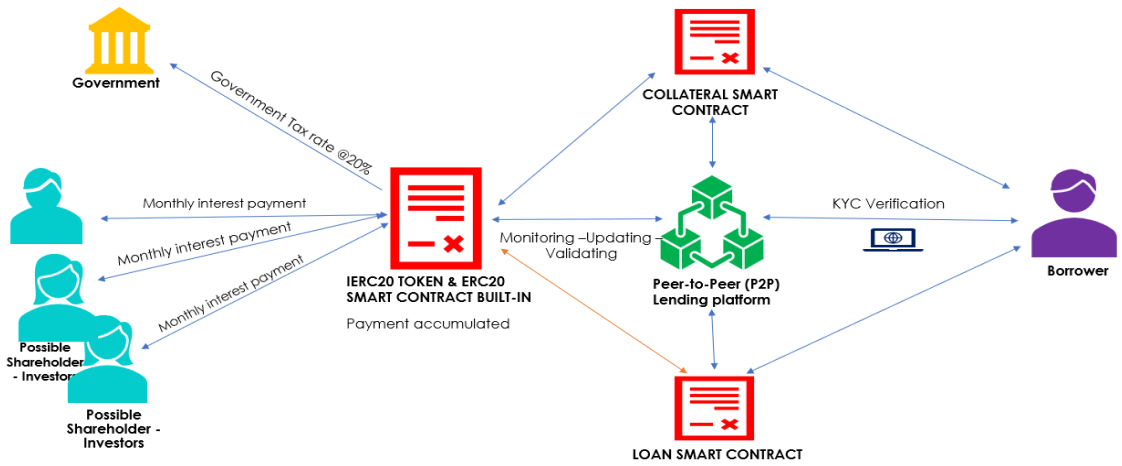


Fig 35: P2P lending smart contracts deployment Architecture Structure

IV. CONCLUSION & FUTURE WORK

In this research paper provides an alternative solution for Peer-to-Peer lending platform on the technological innovations, blockchain smart contracts to capitalise in terms of an effectivity of loan transfers, authenticity (KYC validation), flexibility on rate of interest for all parties (lenders, borrowers including P2P lending platforms whose responsibilities are on the due diligence, exposure to lenders' side of the business.

The immutability and irreversibility of the blockchain technology enable Peer-to-Peer platforms to differentiate from other financial service segments.

Thus, further analyses and investigations could focus on the compensation management smart contract, which was not included in this research project

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Appendix 1

Limitations

Firstly, due to time, interviewees' availability and resources (some Interviewees could not afford to stay longer for the interview because of high-cost mobile data prices in the Democratic Republic of Congo DRC. However, the interviews were conducted mainly focused on the Capital Kinshasa, with the most FinTech entrepreneurs and Peer-to-Peer lending platforms that were consulted, relatively advanced in that regard compared to Lubumbashi, Goma and other states. This may be looked upon as data bias more or less. Thus, further research is required could enable and incorporate more samples in terms of cities and states that have the equivalent level amount of Peer-to-Peer online lending platforms.

Secondly, the last research conducted on the Individual Lending Transition dated until the end of 2020, ceteris paribus as it follows, the findings provided in this research take account of the recent developments in Central Africa, and the Democratic Republic of Congo DRC in particular.

Lastly, this research is the first academic endeavour to analyse "the Impact of the adoption of Peer-to-Peer lending and the regulatory regime in Social-Technical Transition, the case of Congolese individual lending transition" in the Democratic Republic of Congo (DRC). Further research could be carried out on investigating other financial services segments that could have an impact and influence on the transition processes in Central African countries.

Appendix 2

Example of Concept-driven data categorising and coding

The damage of crisis of confidence since the year 2020 regarding the suspension of the online financial management Mygoldrev was a heavy blow to the online lending industry. According to questionnaires and interviews conducted, the number of normal operating Peer-to-Peer lending platforms has dropped significantly to 2 or 3. lending The Central government have highly valued the crisis of confidence; however, the regulatory authority has not yet set out a framework to anticipate further development of the online lending industry. Furthermore, Peer-to-Peer online lending platforms have no guidance policy for supervision, to prevent illegal behaviours, in the case of MyGoldrev. Thus, Peer-to-Peer online lending platforms need to pursue sustainability, rapid growth and development						
	Process-Oriented Dimension			Perception-Oriented Dimension		
Event	Niche	Regime	Landscape	Regulative	Normative	Cultural-Cognitive
Crisis of Confidence		Threatened the (P2P) online lending industry	Increase pressure on the Central Bank of Congo and the Central government	Encouraged the introduction of regulatory policies	Should eradicate illegal behaviours for online (P2P) lending platforms	

Appendix 3

The Impact of the Adoption of Peer-to-Peer lending and Regulatory Regime in Socio-Technical Transitions: The Case of Congolese Individual Lending Transition (Democratic Republic of Congo DRC)

Thank you for taking the time to read this Participant Information Sheet regarding the study in which you are invited to participate, in as part of my master's degree research study at The National College of Ireland (NCI). Your contribution to this study is highly valued and deeply anticipated. However, before deciding whether to participate, it is important that you fully understand what the study involves and what it may involve. For that reason, please take the time to read the following information. Should there be a question or concern which you wish to raise, please feel free to ask me for more information.

Who will conduct the research?

Mr Fiston Kiangata, MSc candidate for MSc in Financial Technology FinTech at National College of Ireland NCI will lead the research.

Title of the Research

The Impact of the Adoption of Peer-to-Peer lending and Regulatory Regime in Socio-Technical Transitions. The Case of the Congolese Individual Lending Transition (Democratic Republic of Congo DRC)

What is the aim of the research?

This research aims to explore how the impact of the adoption of Peer-to-Peer lending platforms and the regulatory regime in socio-technical transitions by investigating the innovative effect of Peer-to-Peer (P2P) lending and the corresponding regulatory regime in Congolese individual lending transition.

Why have I been chosen?

There are stakeholder groups identified as the main actors participating in the Congolese individual lending transition: Peer-to-Peer (P2P lending platforms, regulatory authorities, traditional commercial banks, and P2P lending users. The informants of this research are mainly selected from the above stakeholder groups. In addition, to gain 24. For some more general views of Congolese individual lending transition, journalists are selected as an alternate data source. It is considered that you have the expertise in the innovation of Peer-to-Peer lending or the regulatory regime in any of the above-mentioned perspectives. We are interested in your specific aspirations, views, attitudes, and roles in the Congolese individual lending transition process.

What would I be asked to do if I took part?

By participating in this study, you will be invited to participate in a semi-structured interview via online channels where the researcher will ask a series of open-ended questions.

The interview is intended to be an interactive process through which you are encouraged to express your practical experience and opinions on the impact of the adoption of Peer-to-Peer lending and the regulatory regime in the Democratic Republic of Congo (DRC).Each interview will last approximately 1 hour. The interviews will be audio recorded if your consent

Appendix 4

Table 2.2c Categorising and coding interviewees

Interview Code	Organisation Code	Interviewee role
G1	Peer-to-Peer Lending Platform 1	Director
G2	Peer-to-Peer Lending Platforms 1	Director
G3	Peer-to-Peer Lending Platform 2	Director
G4	Peer-to-Peer Lending Platforms 2	Director
M1	Regulatory authority 1	Official
M2	Regulatory authority 2	Official
M3	Regulatory authority 3	Official
T1	Commercial bank 1	Staff
T2	Commercial bank 2	Staff
D1	NA	User
D2	NA	User
D3	NA	User
D4	NA	User
D5	NA	User
Z1	Online News 1	Journalist
Z2	Online News 1	Journalist
Z3	Online News 2	Journalist
Z4	Online News 3	Journalist
Z5	Online News 4	Journalist
Z6	Online News 5	Journalist
Z7	Online News 6	Journalist
Z8	Online News 7	Journalist
Z9	Online News 8	Journalist
Z10	Online News 9	Journalist

Appendix 5:

List of Variables

Home_internet: which is the proportion of households with Internet access in the DR Congo and its neighbouring countries, generated on the model's inference a Regression dataset, indicate the level of households to access P2P lending online platforms information features.

Mobile_dataprices

Indiv_internet is the percentage of individuals using the internet in DR Congo and neighbouring countries, as generated on the model inference of a Regression dataset, it illustrates the percentage of individuals who could potentially access capital through P2P online lending platforms from investors.

Active_Mobile is the broadband subscriptions per 100 inhabitants, which is generated on the model inference of a Regression dataset, as the fixed broadband subscriptions global rate stands at 12.5 per cent, the African continent estimated around 0.5 per 100 inhabitants, it shows the difficulty for P2P online lending platforms to acquire prospective borrowers.

Growth: this indicator was taken via the World Bank, Organisation Economic Co-Operative Development (OECD) open sources, is generated on the model inference of a Regression dataset, indicates the economic growth of Central African countries, DR Congo in particular and could be useful for P2P online lending platforms as an economic driver.

HDI_2020 Human Development Index (HDI) is created on the model inference of a Regression dataset and serves as a benchmark of DR Congo and neighbouring countries on a literacy basis to help P2P lending platforms in terms of borrower acquisition.

Density the population density as it is produced on the model inference of a Regression dataset and could explore a large number of prospective customers by P2P online lending platforms.

Population_2020 is created on the model inference of a Regression dataset, this data was taken to give a broader perspective of DR Congo and neighbouring countries, which enables P2P online lending platforms to capitalise on their targeted market.

The area is generated on the model inference of a Regression dataset, and this variable in terms of size that P2P online lending platforms could explore to improve businesses' capacity.

EV_regulation is produced on the model inference of a Regression dataset and allows for quantification of the level of regulatory evolution across Central African countries, in DR Congo in particular.