



BANKING AND BLOCKCHAIN ADOPTION: USE CASES ANALYSIS

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Abstract

Blockchain technology has the potential to revolutionize the banking industry by increasing transparency, security, and efficiency in financial transactions.

This study aims to understand how can different banking services make the best use of Blockchain technology, the factors that can lead to the adoption of Blockchain in banking, and its impacts on business models and market structures.

A literature review was performed and interviews were conducted with experts from traditional banking, investment banking and Blockchain development and implementation, to gather their insights.

Findings allowed to provide understand customers' problems and needs, the benefits that blockchain can bring and to build value propositions for seven different banking services or use cases.

Results show that experts agree that loans and credit, trade finance and fundraising are the most valuable use cases for blockchain adoption. Payments and securities trading are seen as the least valuable. Return on investment, technological feasibility and strategic alignment were the most highlighted factors for Blockchain adoption by banks. Business models will be heavily impacted by both the benefits and challenges of Blockchain adoption, and market structures can have profound changes, either for increased concentration, as it is expected for payments, or to increased competitiveness, as it is expected for loans and credit.

Keywords: Blockchain, Banking, Business Models, Value Propositions.

Resumo

A tecnologia Blockchain tem o potencial de revolucionar o setor bancário, aumentando a transparência, segurança e eficiência nas transações financeiras.

Este estudo visa entender como diferentes serviços bancários podem fazer o melhor uso da tecnologia Blockchain, os fatores que podem levar à adoção do Blockchain no setor bancário e seus impactos nos modelos de negócios e estruturas de mercado.

Uma revisão da literatura foi realizada e entrevistas foram conduzidas com especialistas em banca tradicional, banca de investimento e em projetos de desenvolvimento e implementação de Blockchain, para reunir os seus insights.

Os estudos permitiram entender os problemas e necessidades dos clientes, os benefícios que a Blockchain pode trazer e construir propostas de valor para sete diferentes serviços bancários ou casos de uso.

Os resultados mostram que os especialistas concordam que os serviços de empréstimos e crédito, de trade finance e fundraising são os casos de uso mais valiosos para a adoção do blockchain. Pagamentos e trading de títulos são vistos como os menos valiosos. Retorno do investimento, viabilidade tecnológica e alinhamento estratégico foram os fatores mais destacados para a adoção do Blockchain pelos bancos. Os modelos de negócios serão fortemente impactados tanto pelos benefícios quanto pelos desafios da adoção do Blockchain, e as estruturas de mercado podem sofrer profundas alterações, seja por aumento de concentração, como é esperado para pagamentos, seja por aumento de competitividade, como é esperado para o serviço de empréstimos e crédito.

Palavras-chave: Blockchain, Banking, Modelos de Negócios, Propostas de Valor.

Index

| | |
|--------------------------------------------------------|------|
| Acknowledgments | ii |
| Abstract..... | iii |
| Resumo | iv |
| Index of Tables | vii |
| Index of Figures..... | viii |
| 1. Introduction | 10 |
| 2. Literature Review..... | 15 |
| 2.1. Review of Background Concepts | 20 |
| 2.2. Blockchain’s Advantages | 22 |
| 2.3. Blockchain Adoption in Banking Use Cases | 23 |
| 2.4. Blockchain Impact on Banking Business Models..... | 24 |
| 2.5. Challenges of Blockchain Adoption | 25 |
| 2.6. Literature Review Conclusion..... | 26 |
| 3. Methodology | 27 |
| 3.1. Research Question..... | 27 |
| 3.2. Research Design..... | 27 |
| 3.3. Thematic Analysis..... | 27 |
| 3.4. Research Plan | 28 |
| 4. Banking Use Cases | 29 |
| 4.1. Traditional Banking..... | 29 |
| 4.2. Investment Banking | 31 |
| 4.3. Use Cases Business Models..... | 33 |
| 5. Qualitative Interviews..... | 42 |
| 5.1. Units of Analysis..... | 42 |
| 5.2. Data Collection | 43 |

| | |
|---------------------------------------------------------|----|
| 6. Discussion | 45 |
| 7. Interviews Learnings..... | 53 |
| 7.1. Challenges of Banking Customers | 53 |
| 7.2. Blockchain Value Propositions..... | 54 |
| 7.3. Prioritization of Use Cases..... | 62 |
| 7.4. Factors Leading to Blockchain Adoption..... | 64 |
| 7.5. Business Model and Market Structure Dynamics | 68 |
| 7.6. European Regulation Developments..... | 71 |
| 8. Conclusions | 73 |
| 9. Limitations and Future Research | 75 |
| References..... | 76 |
| Annex | 80 |
| 1. Glossary..... | 80 |
| 2. Interviews Scripts..... | 81 |

Index of Tables

| | |
|---------------------------------------------------------------------------------------------|----|
| Table 1. Search results of the bibliographic databases | 15 |
| Table 2. Prisma Flow Diagram..... | 16 |
| Table 3. Literature review (listed by relevance)..... | 18 |
| Table 4. Experts interviewed | 43 |
| Table 5. Experts' opinions on the prioritization of uses cases of traditional banking | 62 |
| Table 6. Experts' opinions on the prioritization of investment banking use cases | 63 |
| Table 7. Experts' opinions on the most relevant factors for Blockchain adoption..... | 65 |
| Table 8. Experts' views on profitability impacts of Blockchain adoption | 65 |

Index of Figures

| | |
|----------------------------------------------------------------------------------------|----|
| Figure 1. Research Plan (Adapted from Braun and Clarke, 2006) | 28 |
| Figure 2. Representation of traditional banking use cases..... | 30 |
| Figure 3. Representation of investment banking use cases | 32 |
| Figure 4. KYC and Fraud prevention business model canvas..... | 34 |
| Figure 5. Loans and Credit business model canvas | 35 |
| Figure 6. Payment's business model canvas | 36 |
| Figure 7. Fundraising business model canvas..... | 38 |
| Figure 8. Securities business model canvas..... | 39 |
| Figure 9. Clearing and settlement business model canvas..... | 40 |
| Figure 10. Trade finance business model canvas | 41 |
| Figure 11. Types of stakeholders..... | 42 |
| Figure 12. Theme Analysis: challenges banking customers..... | 53 |
| Figure 13. Thematic analysis: value propositions..... | 54 |
| Figure 14. KYC and fraud prevention value proposition canvas..... | 55 |
| Figure 15. Loans and Credit value proposition canvas | 56 |
| Figure 16. Payments value proposition canvas | 57 |
| Figure 17. Fundraising value proposition canvas..... | 58 |
| Figure 18. Securities value proposition canvas..... | 59 |
| Figure 19. Clearing and Settlement value proposition canvas | 60 |
| Figure 20. Trade finance value proposition canvas | 61 |
| Figure 21. Thematic analysis: Prioritization of use cases in traditional banking | 62 |
| Figure 22. Thematic analysis: prioritization of use cases in investment banking..... | 63 |
| Figure 23. Thematic analysis: factors leading to Blockchain adoption..... | 64 |
| Figure 24. Thematic analysis: business model dynamics | 68 |

| | |
|---------------------------------------------------------------------------------------|----|
| Figure 25. Thematic analysis: market structure dynamics | 69 |
| Figure 26. Experts' views on the market structure impacts of Blockchain adoption..... | 71 |
| Figure 27. Thematic analysis: European regulation developments | 72 |

1. Introduction

Blockchain has the potential to change the world. It's a disruptive force that cannot be disregarded and, most of all, it cannot be ignored by the industry at the center of the revolution: the banking industry.

But the banking industry provides several services which are different use cases for Blockchain. Should banks adopt Blockchain for all these different use cases? How can banks improve their services with Blockchain? What are the business model implications of adopting Blockchain?

Context and Motivation

The first decentralized Blockchain was conceptualized during the great financial crisis of 2008, by an academic paper by an anonymous person(s), with the alias of "Satoshi Nakamoto", that intended to create a "trust-less" cash system. Nakamoto's groundbreaking work combined cryptographic techniques, peer-to-peer networks, and consensus algorithms to enable secure, transparent, and censorship-resistant transactions with a new "currency", a cryptocurrency: Bitcoin (Nakamoto, S., 2008).

As the potential of Blockchain technology became evident, researchers began to explore its applications beyond cryptocurrencies. Vitalik Buterin, 2013, introduced Ethereum, a Blockchain platform that supported the development of smart contracts (Buterin, V., 2014). A smart contract is a self-executing digital contract that operates on a Blockchain platform, that automatically executes predefined actions or conditions once specific criteria are met.

The growth of the crypto market continued in the subsequent years, with thousands of new cryptocurrencies being created.

Blockchain is the underlying technology that enables the existence and functioning of cryptocurrencies, but that has significantly broader applications beyond just digital currencies. It is a decentralized and distributed ledger technology that records and verifies transactions across multiple computers or nodes (Tapscott, D. & Tapscott, A., 2017). And it is this potential to be used in various industries and different use cases that it's also being increasingly explored. It can be utilized for supply chain management, healthcare, voting systems, intellectual property protection, banking, and much more (Swan, M., 2015).

For the banking industry, Blockchain offers the ability to streamline various banking processes or use cases, including cross-border payments, identity verification, and supply chain finance.

Although a lot has already been done in the applications of Blockchain in the banking industry, it is still questioned why such a powerful technology, that can make banking processes cost a fraction, allows for processes to be executed much more quickly, and provides the most transparent system of trust, is still somewhat behind on its wide acceptance by the banking industry.

For sure that the application of Blockchain to the banking industry should not be a situation where “one-size-fits-all” banking use cases. Each banking service or use case needs to be analyzed individually, and needs to be well understood within the context of the banking system and its operations. New Blockchain value propositions need to be constructed and discussed to understand the value added to the new value proposition, the business model implications to each use case, and its reflection on the competition and strategy dynamics.

Blockchain and Banking

Blockchain technology has the potential to revolutionize the banking industry by increasing transparency, security, and efficiency in financial transactions. According to a report by the World Economic Forum, the use of Blockchain in the financial services sector could potentially add \$1 trillion to the global economy by 2025 (World Economic Forum, 2018).

Several major banks have already begun to explore the use of Blockchain technology. For example, JPMorgan Chase has developed Quorum (JPMorgan Chase, 2016), a Blockchain platform that is being used to streamline the bank's settlement and clearance processes. The platform also allows the secure sharing of customer information between different banks and financial institutions, reducing duplication of efforts and improving the efficiency of KYC processes. It enables real-time updates and verification of customer data, enhancing compliance with regulatory requirements.

Similarly, Santander has developed a Blockchain-based platform for cross-border payments, which it has been piloting in several countries (Santander, 2018).

Santander also and BBVA, two major Spanish banks, have implemented Blockchain technology for syndicated loan transactions. They utilized Blockchain platforms to streamline and automate the loan issuance process, including negotiation, settlement, and

record-keeping. This reduces the time and complexity associated with manual processes and improves transparency among the participating parties. (Swan, M., 2015).

Blockchain-based solutions are also being deployed to improve transparency and traceability in supply chains. These applications facilitate secure and efficient trade finance processes, reducing fraud, and enhancing trust between participants. HSBC has utilized Blockchain technology to digitize and streamline trade finance processes, including issuing letters of credit. By leveraging Blockchain platforms, HSBC aims to reduce paperwork, enhance efficiency, and improve transparency in trade finance operations. This allows for faster transaction settlement and reduces the risk of fraud and errors (Iansiti, M., & Lakhani, K. R., 2017).

Société Générale, a French multinational bank, conducted a successful pilot project using Blockchain technology for the tokenization of covered bonds. By issuing security tokens on a Blockchain, the bank aimed to enhance the liquidity and transparency of these financial instruments. The project demonstrated the potential for Blockchain-based tokenization to streamline the issuance, settlement, and secondary market trading of traditional financial assets (Gourard, L., & Cournède, B., 2020).

In addition, the number of venture capital investments in Blockchain-based companies has grown exponentially in recent years, with venture capital investments in Blockchain-based companies reaching \$1.5 billion in 2018 alone, according to a report by PwC (PwC, 2018).

Even Governments and central banks are exploring the development of Central Bank Digital Currencies (CBDCs), digital currencies issued and regulated by central authorities. CBDCs built on Blockchain technology could provide a secure and efficient payment infrastructure, reducing costs and enhancing financial inclusion (Bank for International Settlements., 2021).

With its ability to increase transparency, security, and efficiency in financial transactions, we will likely see more and more banks adopt Blockchain technology in the coming years.

However, widespread adoption by the banking industry has been relatively slow. A few macro-level challenges hindering the widespread adoption of Blockchain in banking can be found in academic literature, such as: scalability concerns, as the banking industry requires a robust infrastructure capable of handling a large volume of transactions in real-time; the still weak regulatory environment, in a heavily regulated environment to ensure stability, security, and compliance; the lack of interoperability and common standards across different Blockchain platforms hinders seamless integration with existing banking systems; and security and privacy concerns, regarding the vulnerability of smart contracts, private key

management, and data privacy (Yli-Huumo, J., Ko, D., Choi, S., Park, S., & Smolander, K., 2016).

On a micro-level, on the specific banking use case level, we can also find specific concerns: the value added for the adoption of Blockchain might be limited; the transformation of the banking process with Blockchain can change the business model and impact the business revenues and margins; Blockchain adoption can remove the need for an intermediary in the process altogether; competition dynamics can change to favor fewer players or in the opposite way it can open the market to many more players.

A lot is still to be understood from these dynamics, and therefore collaborative efforts among researchers, industry players, and regulatory bodies are crucial to developing solutions and establishing frameworks that enable the secure and efficient integration of Blockchain technology in the banking sector. By addressing these challenges, either macro or micro, Blockchain can potentially unlock transformative opportunities, enhancing transparency, efficiency, and trust in the banking industry.

Objectives for the Dissertation

The main objectives of this dissertation will be to understand how can different banking services make the best use of Blockchain technology, the factors that can lead to the adoption of Blockchain in banking, and its impacts on business models and market structures.

It will be important to provide a clear overview of the banking use cases and business models.

It is also an objective to identify specific Stakeholders, represented by banking and Blockchain experts, who can provide insights regarding the purpose of the research.

Research Methodology

The investigation methodology that is used will be composed of a literature review and a thematic analysis, that allows to capture patterns and commonalities in the perspective of experts about the business potential of Blockchain use cases for the banking industry in light of the objectives of the dissertation.

Dissertation Structure

The dissertation starts with the literature review, which includes the reviewing of concepts and ideas on the topic of Blockchain, that have been published, and in particular on the adoption of Blockchain by the banking industry, and in different services or use cases. This leads to the definition of the gap in the literature to explore.

Afterward, it is presented the research question, the research methodology that was chosen, the thematic analysis, and the research plan.

Next, the banking use cases to be analyzed are defined and presented using the business model canvas, which provides a detailed overview of each use case.

In the following section, it explained how the qualitative interviews with experts were defined and how they were performed. A discussion of the interviews is included, highlighting insights that experts gave.

Interviews learnings followed, presenting the main themes that were identified according to thematic analysis.

Finally, conclusions are taken and reflections on future research opportunities are shared.

2. Literature Review

A literature review serves as a critical component of a dissertation. It involves a systematic and comprehensive examination of existing literature and research studies relevant to the topic of investigation. Its contributions analysis helps to make clear the knowledge gap that might exist and that can be worth exploring.

Blockchain is a broad subject to research. We can search its applications in different geographies, in different industries, and with different purposes. For this study, the academic research was framed on the following initial research question: how can the banking industry business models make the best use of Blockchain technology?

With this initial framing, related keywords were selected to perform the searches, such as: “Blockchain”, “banking”, “innovation”, “defi”, “business model”, “value proposition”.

To select the most relevant academic papers for the literature review, the bibliographic databases Scopus and WoS were used, together with online searches. The following table presents the search results of the Bibliographic databases:

Table 1. Search results of the bibliographic databases

| # | KEY Word Search Combination | # Papers | Date of Search | File Name |
|---------------|-------------------------------------------------|----------|----------------|-----------------------------------|
| SCOPUS | | | | |
| 1 | KEY (innovation AND banking AND Blockchain) | 10 | 06-10-2022 | innovation banking Blockchain |
| 2 | KEY (banking AND Blockchain AND cryptocurrency) | 28 | 13-10-2022 | banking Blockchain cryptocurrency |
| 3 | KEY (Blockchain AND defi) | 36 | 13-10-2022 | Blockchain defi |
| 4 | KEY (Blockchain AND (investment AND banking)) | 8 | 13-10-2022 | Blockchain investment banking |
| 5 | KEY (Blockchain AND (business AND model)) | 0 | 03-11-2022 | |
| 6 | KEY (Blockchain AND (value AND proposition)) | 16 | 03-11-2022 | Blockchain value proposition |

| # | KEY Word Search Combination | # Papers | Date of Search | File Name |
|------------|---------------------------------------|----------|----------------|-----------------------------|
| WOS | | | | |
| 7 | innovation AND banking AND Blockchain | 3 | 05-11-2022 | innovation banking blocking |
| 8 | Blockchain AND business model | 0 | 05-11-2022 | |

Prisma Flow Diagram

To narrow down the list of papers to review, the Prisma Flow Diagram methodology (Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D., 2021) was used. The Prisma flow diagram visually summarizes the screening process. It initially records the number of articles found and then makes the selection process transparent by reporting on decisions made at various stages of the systematic review. Number of articles are recorded at the different stages.

Table 2. Prisma Flow Diagram

| Phase | Step | # Records |
|----------------|---------------------------------------------|-----------|
| Identification | Records identified | 101 |
| Identification | Additional records | 11 a) |
| Identification | Records after removing duplicates | 102 |
| Screening | Records screened | 102 |
| Screening | Records excluded | 60 b) |
| Eligibility | Full-text articles assessed for eligibility | 42 |
| Eligibility | Full-text articles excluded | 28 c) |
| Included | Articles included | 17 |

Criteria for Selection and Exclusion of Articles

a) Additional records include papers recommended by the thesis supervisor (3), papers from the University of Porto (2), and papers found in online searches (6).

b) The criteria for exclusion were: the geographic focus of the study (31), as the focus of the study is not intended to be local but global; the industry of study (26), as the focus of the study is only in the banking industry; and use cases (3), as the focus of the study is on banking services use cases.

c) The criteria for exclusion were data duplication (4) and insufficient value-added for the topic to be covered (14).

Assessment of the Search Results

Although the topic of cryptocurrencies is far more researched than Blockchain as the 4:1 proportion of papers on Bitcoin to the papers about Blockchain applications shows (Zile, K., & Strazdiņa, R., 2018), the available literature on the topic of Blockchain is large and diversified. Due to the direct implications of the explorations of alternative currencies and contracts, the study of the use of Blockchain for other banking use cases and services is thorough. For the selection of papers, we discarded geographically focused studies and embraced globally designed research on the implications of the adoption of Blockchain in the different use cases of banking services.

Selected Articles

After narrowing down the list of papers for the literature review, 17 papers were selected. Although always focusing on the topic selected, Blockchain in banking, different papers with different purposes were selected. From papers that provided an overview of the topic and its main functionalities, to papers that analyze future impact in business models. From papers that explained the main concepts and provided a concepts review, to papers that explore the different use cases of banking and its potential.

The following table summarizes the insights gathered from this exploration:

Table 3. Literature review (listed by relevance)

| Subject | Title | Author(s) |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| Blockchain in Banking | Blockchain: Blueprint for a new economy | Swan, M. (2015) |
| | Provides a introduction to Blockchain technology and its impact on various industries. | |
| Banking Use Cases | Blockchain in the financial industry: Use cases and challenges | Kshetri, N. (2018) |
| | Discusses the potential use cases and challenges of using Blockchain technology in the financial industry. Payments, settlement, and clearing systems, lending, insurance, and digital identity. | |
| Banking Use Cases | Blockchain Technologies Applied to Interbank Transactions | Duarte, J. C. R. (2019). |
| | The paper provides a solution based on cryptocurrency/Blockchain technology to simplify interbank transactions. A private cryptocurrency/fiat exchange is proposed for each bank, that is autonomous and allows for quasi-instant money transfers to other banks. | |
| Business Models | Blockchain challenges and opportunities: A survey | Zheng, Z., Xie, S., Dai, H. N., Chen, X., & Wang, H. (2017) |
| | Provides a comprehensive survey of the challenges and opportunities associated with Blockchain technology. It covers various aspects including scalability, security, privacy, interoperability, consensus mechanisms, and regulatory considerations. | |
| Banking Use Cases | Blockchain technology and startup financing: A transaction cost economics perspective | Ahluwalia, S., Mahto, R. V., & Guerrero, M. (2020). |
| | There are several issues in Startup Financing, like information asymmetry and transaction costs that Blockchain can improve. This paper proposes a model based on the theory of transaction cost economics and the transactional nature of Blockchain technology to overcome these issues. | |
| Banking Use Cases | Do we still need financial intermediation? The case of decentralized finance–DeFi | Grassi, L., Lanfranchi, D., Faes, A., & Renga, F. M. (2022). |
| | The paper looks to assess the role of intermediation in the light of decentralized finance (Defi). It highlights the benefits of Defi and algorithms to handle transactions, but it also points out the risks and the need to keep human intervention to control possible illegal behavior. | |

| Subject | Title | Author(s) |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------|
| Business Models | Tokenization of Assets and Securities on the Blockchain: Business and Legal Perspectives | Broumandi, M., & Azad, M. A. K. (2020) |
| Explores the concept of tokenization and its application to assets and securities on the Blockchain. | | |
| Business Models | The value proposition of Blockchain technologies and its impact on digital platforms | Zutshi, A., Grilo, A., & Nodehi, T. (2021). |
| The paper provides a view of a set of value propositions for the use of Blockchain in digital platforms and business ecosystems. The literature review presents a systematization of the value concepts and how they can be harnessed. | | |
| Banking Cases | Use Blockchain Technology in The Banking Sector: Applications and Challenges | Toubal, M., & Dilé, C. (2021) |
| This paper researches Blockchain technology applications for the banking sector and the challenges facing the adoption of the technology. | | |
| Business Models | The Impact of Blockchain Technology on business models in the payments industry | Holotiuk, F., Pisani, F., & Moormann, J. (2017) |
| Study the impact of Blockchain in payments business models. Indicates that Blockchain allows for the offering of new banking services and renders some of the current ones obsolete. | | |
| Banking Cases | Use Blockchain use cases and their feasibility | Zile, K., & Strazdiņa, R. (2018) |
| Overview of possible use cases and implications in several industries including banking. | | |
| Blockchain in Banking | Bitcoin: Economics, Technology, and Governance | Böhme, R., Christin, N., Edelman, B., & Moore, T. (2015) |
| Explores the economic implications of the cryptocurrency, the underlying technology of the Blockchain, and the governance mechanisms within the Bitcoin network. | | |
| Banking Cases | Use A review of Blockchain Technology applications for financial services | Javaid, M., Haleem, A., Singh, R. P., Suman, R., & Khan, S. (2022) |
| The paper identifies and evaluates the applications of Blockchain technology in the financial services industry. | | |

| Subject | Title | Author(s) |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| Banking Use Cases | Blockchain adoption model for the global banking industry | Kawasmi, Z., Gyasi, E. A., & Dadd, D. (2020) |
| | Studies the factors that are indicated as the most relevant to lead to the adoption of Blockchain to several banking services use cases. Safeguards for the need for regulatory support for the adoption of Blockchain. | |
| Blockchain in Banking | Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction | Narayanan, A., Bonneau, J., Felten, E., Miller, A., & Goldfeder, S. (2016) |
| | Covers the fundamental concepts and principles behind Blockchain technology, explores the mechanics of Bitcoin transactions, addresses the challenges of privacy and security, and delves into the broader implications of cryptocurrencies in finance, economics, and society. | |
| Blockchain in Banking | Systematic Literature Review on Application of Blockchain Technology in E-Finance and Financial Services | Trivedi, S., Mehta, K., & Sharma, R. (2021) |
| | Literature review of Blockchain development, challenges, and applications in the financial sector. | |
| Blockchain in Banking | Understanding and applying Blockchain technology in banking: Evolution or revolution? | Buitenhek, M. (2016) |
| | The paper highlights the work that the industry needs to do to make Blockchain applications a mainstream part of the financial landscape. | |

2.1. Review of Background Concepts

Blockchain is a decentralized and distributed digital ledger technology that records transactions across a network of computers. It is best known as the technology that underpins the cryptocurrency, Bitcoin. It consists of a chain of blocks, where each block contains a list of transactions, a timestamp, and a reference to the previous block, creating a chronological and tamper-resistant record of all transactions. Blockchain technology ensures transparency, immutability, and security by utilizing cryptographic algorithms and consensus mechanisms (Tapscott, D. & Tapscott, A., 2017).

However, its potential applications extend far beyond digital currencies, and it has the potential to revolutionize various industries, including finance, supply chain management, healthcare, and more.

This is a review of the main background concepts around Blockchain, that will be mentioned in the dissertation:

1. Distributed Ledger Technology (DLT): DLT is the underlying technology behind Blockchain that allows multiple participants to have a synchronized and shared database. It provides transparency, immutability, and decentralization (Tapscott, D., & Tapscott, A., 2017).
2. Consensus Mechanisms: Consensus mechanisms are algorithms used in Blockchain networks to achieve agreement on the validity of transactions and the state of the Blockchain. Examples include Proof of Work (PoW) and Proof of Stake (PoS) (Narayanan, A., Bonneau, J., Felten, E., Miller, A., & Goldfeder, S., 2016).
3. Smart Contracts: Smart contracts are self-executing contracts with predefined rules and conditions encoded on the Blockchain. They automate the execution and enforcement of contractual agreements without the need for intermediaries (Szabo, N., 1997).
4. Cryptography: Cryptography plays a crucial role in securing transactions and ensuring data integrity on the Blockchain. It involves encryption, digital signatures, and cryptographic hashing algorithms (Katz, J., & Lindell, Y., 2014).
5. Immutable Ledger: The Blockchain ledger is immutable, meaning that once data is added to the Blockchain, it cannot be altered or deleted. This property ensures the integrity and trustworthiness of the information (Antonopoulos, A. M., 2014).
6. Decentralization: Blockchain technology enables decentralization by removing the need for a central authority or intermediary. Instead, consensus algorithms and network participants validate the Blockchain collectively (Swan, M., 2015).
7. Tokenization: Tokenization involves representing real-world assets or rights as digital tokens on a Blockchain. This enables fractional ownership, enhances liquidity, and facilitates the transfer of value (Mougayar, W., 2016).
8. Privacy and Confidentiality: Blockchain technology offers varying degrees of privacy and confidentiality. Different Blockchain architectures, such as public, private, and hybrid Blockchains, provide different levels of data visibility and access control (Zheng, Z., Xie, S., Dai, H. N., Chen, X., & Wang, H., 2017).

In summary, Blockchain is a decentralized, distributed ledger technology that uses cryptography to secure and validate transactions, it is immutable and transparent, and it allows for the creation of smart contracts and the automation of digital agreements.

2.2. Blockchain's Advantages

Since the financial crisis of 2008, the banking industry has been suffering. Marked by egregious commercial practices, exaggerated management bonuses, and the disregard for their financial safety, the banking crash left them in a very fragile position.

Banks have always maintained a strong competitive position and an important contributor has been their IT investments. They have contributed over the years to banks to achieve more efficiency, security, and transparency of their transactions and processes. But legacy IT systems only keep getting older and radical changes are very hard to accomplish, leaving banks at the mercy of fierce fintech startup competition and technology disruption.

Blockchain has the potential to revolutionize the banking industry. The technology behind cryptocurrencies like Bitcoin, is a decentralized, digital ledger that records transactions across a network of computers. This technology has the potential to transform the way banks operate, and it is already being explored by several banks and financial institutions. As explained by (Zile and Strazdiņa, 2018) Blockchain technology can improve the security, efficiency, and transparency of financial transactions. Therefore, there is no surprise that there is a growing interest in the use of Blockchain technology in the banking industry.

The most significant advantage of Blockchain in banking is its ability to improve transparency and security. Blockchain's decentralized nature ensures that transactions are recorded in multiple locations, making it almost impossible for hackers to tamper with the data. This increases the security of banking transactions, and it also makes it easier for regulators to track and monitor transactions. Additionally, Blockchain's distributed ledger technology allows for real-time tracking of transactions, improving the transparency of the banking system.

Blockchain eliminates single points of failure by using a dispersed network that subjects every transaction to complex encryptions interconnected with the next, making it one of the most effective cyber-defense systems against hacking and fraud. Transactions can be managed, approved, and logged instantly through Blockchain, reducing laborious authentication and verification processes. Blockchain also provides unprecedented visibility into the whole life cycle of a transaction or value exchange within a bank's operations, reducing the need for costly and time-consuming third-party verifications. By using Blockchain, error and fraud rates fall, administrative costs fall, and the necessity for redundant storage of customers' sensitive financial data is nearly eliminated.

2.3. Blockchain Adoption in Banking Use Cases

Blockchain-based frameworks for the banking industry have been proposed by (Ahluwalia et al., 2020) and (Mia et al., 2022) that aim to improve security and transparency in financial transactions. Due to the various financial services provides by the banking industry, several use cases are being studied to harness the powers of the Blockchain.

In payments, Blockchain can contribute to making them faster and cheaper by building a decentralized channel. In Cross-border payments, (Grassi et al., 2022) and (Javaid et al., 2022) suggests that technology can improve the speed and security of these transactions.

In digital identity verification, Blockchain technology can be used to create digital identities that are secure, immutable, and portable. This can be used to improve the efficiency and security of customer onboarding processes in banks (Toubal and Dilé, 2021). Blockchain-based digital identities can also be used to create a more secure environment for online banking and e-commerce transactions as suggested by (Buitenhek, M, 2016).

In Trade Finance, (Zutshi et al., 2021) defends that Blockchain can improve the efficiency and security of trade finance operations. Trade finance are activities associated with international trade and business and many still rely on paperwork like invoices, letters of credit, or bills today. With the elimination of time-consuming manual processes, paperwork, and bureaucracy, Blockchain-based trade finance can streamline the trading process.

In Borrowing or Lending, with the use of Smart contracts, which are self-executing contracts that are stored on the Blockchain, Blockchain can automate the banking processes. This can significantly reduce time and costs (Holotiuk, Pisani, and Moormann, 2017).

Blockchain-based tokenization allows the representation of securities as digital tokens. This fractional ownership enables greater liquidity and accessibility to a broader range of investors. Broumandi and Azad (2020) explore the potential of Blockchain-based tokenization in enhancing liquidity and expanding investment opportunities in the securities market.

In KYC (Know Your Customer) processes and Anti-Money Laundering (AML) compliance, Blockchain technology can be used to increase transparency, efficiency, and security (Trivedi, S., Mehta, K., & Sharma, R., 2021). Furthermore, it can also help banks to share customer data across different financial institutions securely and efficiently, reducing compliance costs.

In the settlement of transactions, Blockchain technology can be used by banks to settle transactions and track them more effectively than existing protocols like SWIFT. Blockchain eliminates the need for intermediaries and regulatory organizations, enabling banks to process and settle transactions promptly.

In the buying or selling of assets using Blockchain can save the global trade process significant expenses by removing middlemen and transferring asset rights.

2.4. Blockchain Impact on Banking Business Models

Blockchain adoption can impact banking business models significantly. In cost structures, it can significantly improve operational efficiency and reduce costs. Blockchain-based solutions can automate manual processes, reduce the need for intermediaries, and enable real-time transaction settlement. Research by Swan (2015) highlights how Blockchain can streamline processes, enhance transparency, and reduce costs across various banking functions.

Another impact on the sustainability of business models comes from the immutability and cryptographic security features of Blockchain that can strengthen the security of banking systems. Blockchain-based solutions can provide secure identity management, KYC processes, and transaction validation. Academic literature by Zheng et al. (2017) explores how Blockchain can enhance security, trust, and fraud prevention in financial transactions.

Regarding revenues, Blockchain adoption opens up opportunities for banks to explore new revenue streams. For instance, banks can leverage Blockchain for tokenization, allowing the creation and trading of digital assets. This can facilitate fractional ownership, enhance liquidity, and enable new investment opportunities. Broumandi and Azad (2020) discuss the potential of Blockchain-based tokenization in creating new revenue models.

While Blockchain adoption in banking offers numerous benefits, it also poses potential challenges and negative impacts on business models.

Blockchain technology enables direct peer-to-peer transactions, bypassing the need for intermediaries such as banks and payment processors. This disintermediation could lead to a reduction in revenue streams for banks that heavily rely on transaction fees and other intermediation-based services. Research by Zheng et al. (2017) discusses the potential disruption caused by Blockchain in disintermediating financial transactions.

As Blockchain technology matures, new financial service providers leveraging Blockchain can emerge. These decentralized platforms can offer alternative financial services such as

lending, crowdfunding, and asset management, challenging traditional banking models. Banks may face increased competition, potentially leading to a decline in their revenue streams. Swan (2015) highlights the emergence of decentralized financial applications as potential competitors to traditional banking services.

Blockchain-based cryptocurrencies and stablecoins, a cryptocurrency pegged to a stable currency such as the euro or dollar, provide an alternative means of conducting transactions without the involvement of traditional banking payment systems. As these digital currencies gain adoption, banks may experience reduced revenue from payment processing services, including transaction fees and foreign exchange charges. The research by Narayanan et al. (2016) examines the impact of cryptocurrencies on traditional payment systems.

While Blockchain adoption can streamline operations, it also comes with implementation costs. Banks need to invest in Blockchain infrastructure, talent acquisition, and system integration, which may impact short-term profitability. The research by Böhme et al. (2015) discusses the potential costs and challenges associated with Blockchain implementation in financial institutions.

Within this environment, banks must carefully assess and adapt their business models to navigate these challenges and explore opportunities for collaboration and innovation in the evolving Blockchain landscape.

2.5. Challenges of Blockchain Adoption

Despite the potential benefits and threats of Blockchain in banking, there are still several challenges and obstacles that need to be overcome. One of the main challenges is regulatory uncertainty. The importance of security and regulatory compliance in the implementation of Blockchain in the banking sector is emphasized (Duarte, 2019) as well as the importance of security and scalability (Kshetri, 2018). Banks and financial institutions are still unsure of how to comply with existing regulations, and it is unclear how Blockchain technology will be regulated in the future. Additionally, there is a lack of standardization in Blockchain technology, which makes it difficult for banks to choose the right platform for their needs (Ahluwalia et al., 2020., Mia et al., 2022).

In general, the literature review suggests that while Blockchain technology has the potential to bring significant benefits to the banking industry in terms of transparency, security, and

efficiency, more research is needed to fully understand the implications and to address the challenges that arise in the implementation process.

2.6. Literature Review Conclusion

The literature review has provided clarification of the concepts and ideas which are relevant to the analysis. It provided the establishment of a basis of knowledge regarding the benefits of Blockchain adoption by the banking industry but also its challenges, how banking use cases can be impacted by Blockchain, how and business models can be affected.

There is a growing consensus on the importance of Blockchain technology and its importance for the future of banking. Its benefits are significant and applicable in a large set of banking services that have the potential to be Blockchain use cases.

Although we have in the literature a good macro-overview of the positive impacts and the challenges of Blockchain adoption, and a micro-overview of the benefits of Blockchain adoption in specific use cases, we are still missing the discussion of the strategic business model considerations of the industry for the adoption of Blockchain in specific banking use cases, within banks operational structure and current competitive landscape.

Gap to Fill in Literature

This dissertation will try to fill the gap in the literature regarding the evaluation of the adoption of Blockchain technology by specific banking services and its business model implications.

3. Methodology

3.1. Research Question

The definition of a research question guides the direction of the research by providing a focus and a purpose for the study. Given the conclusion of the literature review and the gap that was identified, the research question that is attempted to answer in this dissertation is:

How can different banking services make the best use of Blockchain technology?

3.2. Research Design

Research design refers to the overall plan or strategy that guides the research process, including the selection of research methods, data collection procedures, and data analysis techniques. It encompasses the decisions made by researchers regarding how they will address their research question(s) or objective(s) (Merriam, S. B., 2009).

To pursue the answers to the research question, a list of use cases is going to be defined and, to gather insights on the evaluation of the Blockchain adoption, it has been considered to be more valuable the consultation of a group of experts through an interview process.

As a consequence, the adequate methodology for this process is the thematic analysis. This methodology allows us to capture patterns and commonalities from the perspective of experts about the business potential of Blockchain use cases in the banking industry.

Thematic analysis is a flexible and systematic approach to analyzing qualitative data. It involves identifying and interpreting recurring patterns of meaning, known as themes, within the data. Braun and Clarke (2006) present a comprehensive guide to thematic analysis, highlighting its iterative and inductive nature.

3.3. Thematic Analysis

Thematic analysis typically involves several key steps: familiarization with the data, to gain a comprehensive understanding of the content and context; coding, by assigning labels or codes to segments that capture important concepts, ideas, or patterns; theme identification, by grouping codes that represent patterns or concepts that are relevant to the research question or objective; theme development, by reviewing and defining the identified themes,

ensuring coherence and internal consistency; data interpretation of the themes concerning the research objectives, by examining the relationships between themes, exploring variations, and generating insightful interpretations; and reporting, by presenting the findings in a coherent and meaningful manner.

3.4. Research Plan

Following the literature review, the identification of the literature gap, and the definition of the research question, the next phases of the study will start with the analysis and definition of banking use cases that are considered for this study. The Business model canvas framework is used to present a detailed overview of each use case.

A list of specific stakeholders is then defined to be interviewed, to gather qualitative insights from knowledgeable persons related to the banking industry and Blockchain development. An interview script is prepared, and interviews are performed, transcribed, and analyzed.

With the qualitative data collected, thematic analysis methodology follows, with the familiarization of the data as an important step. Afterward, codes and concepts are formed that allowed us to search for themes. These themes are analyzed and defined. They are interpreted within the objectives of the research question and finally reported in this document, with a focus on adding value to existing literature and academic knowledge.

In summary, the research plan of this dissertation is composed of 4 phases: the definition, the planning, the data collection, and the thematic analysis:

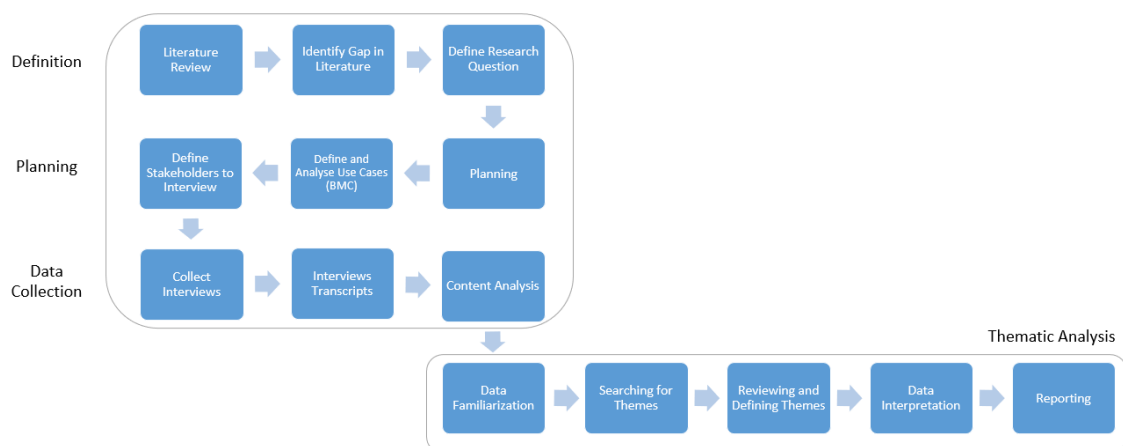


Figure 1. Research Plan (Adapted from Braun and Clarke, 2006)

4. Banking Use Cases

For the definition of the use cases selected to be analyzed, it was considered the objective of having a broad set of use cases from both traditional banking and investment banking, the number of references of each use case in the literature review, its relevance and feasibility for the incorporation of Blockchain technology and the personal and professional experience and knowledge of the author of this thesis regarding the use cases.

Therefore, related to traditional banking activities, the use cases that were chosen to be analyzed within the objectives of this thesis were: I. Customer KYC and Fraud Prevention, II. Loans and Credit and III. Payments. Within the investment banking activities, the use cases selected were: IV. Fundraising, V. Securities, VI. Clearing and Settlement and VII. Trade Finance.

To provide context to how these use cases work within the set of banking processes, let's discuss their origins, and how they are provided by banks and used by customers, within the framework of traditional banking and investment banking.

4.1. Traditional Banking

Traditional banking refers to the services and activities provided by banks to individuals and businesses, either savers that have excess cash, or borrowers who need cash. These services include deposits, loans, and other financial products. The history of traditional banking dates back to ancient times, with the earliest known banking activities occurring in Mesopotamia around 2000 BC. Throughout history, banking has played an important role in facilitating commerce and economic development (S. K. Singh, 2004).

In modern times, traditional banking involves many key processes. One of the primary activities is the acceptance of deposits from customers, which are then used to provide loans and other financial services. Banks also engage in risk management activities, such as assessing the creditworthiness of borrowers and monitoring their loan repayments (J. O'Sullivan, 2014). In addition, banks provide a range of other financial services, such as transfers, allowing customers to move funds to other internal or external accounts, and payments, ensuring the convenience for their customers to use their funds to purchase in a vast network of merchants all over the world. Nowadays, it is also critical to the initial and ongoing process of Know Your Customer, to make sure that those who access banking

services are trusted and do not engage in fraudulent activities. We can see a representation of these main use cases in the diagram below:

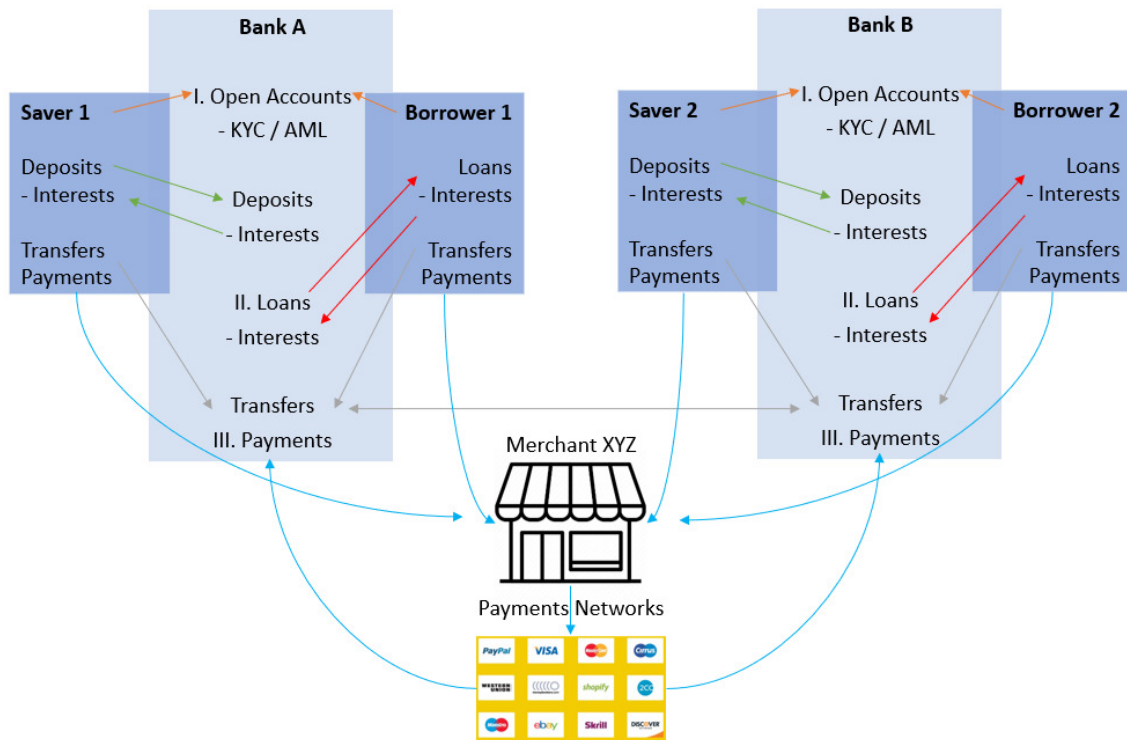


Figure 2. Representation of traditional banking use cases

Any person, either individual or company, who needs to access financial services, needs to first open an account with their chosen bank. Within this process, banks need to collect information to comply with KYC regulations (I. Customer KYC and Fraud Prevention use case).

If the person is a saver, he will probably make deposits or other applications to get a return on those. Banks will pay interest for that. With the money from deposits, banks can then lend it out to other persons, and get themselves an even higher return for that. Therefore, they make loans to borrowers who need cash, and that convinces banks they can pay their money back (II. Loans and Credit use case).

Bank customers can also use their bank accounts to access other financial services. They can make transfers, sending money to other accounts within the same bank or to other banks, or they can also support payments.

Payments processes (III. Payments use case) rely on payment networks that were built for many years and have made agreements, on one side with merchants all over the world for

them to accept payments of customers in their networks, and on the other side with banks, who allow for them to access customers funds if they provide their consent. So, whenever a payment is made by a customer on a merchant that is connected to a payment network, that network immediately connects with the customer's bank and, if funds are available, allows for the payment to be made.

Overall, traditional banking remains a critical part of the global financial system, playing an important role in supporting economic growth and development (G. P. Rajan and L. Zingales, 1998).

4.2. Investment Banking

Investment banking's main activities are to help companies and governments to raise capital by underwriting and selling securities and also support the trading activities of those securities. The origins of investment banking can be traced back to the 17th century when wealthy merchants and financiers began providing funding for overseas trade ventures (S. K. Jain, 2004).

Today, investment banking firms typically offer a range of services, including equity and debt underwriting, mergers and acquisitions advisory, securities trading, and asset management (R. S. Ruback, 2015). Investment bankers work with companies to structure securities offerings, help price and market them to investors, and manage the entire process of raising capital (IV. Fundraising use case). This can involve conducting due diligence on a company's financials, assessing market conditions, and providing advice on the best course of action (S. G. Ryan and A. G. Timmermann, 2012).

Investment bankers also play a role in the trading activities of customers (V. Securities Trading use case). To support the trade lifecycle, investment banks also need to provide access to the clearing and settlement of trades (VI. Clearing and Settlement use case).

In addition, investment banking firms may provide advice on a range of strategic issues, such as corporate restructuring, divestitures, and initial public offerings.

We can see a representation of these main use cases in the diagram below:

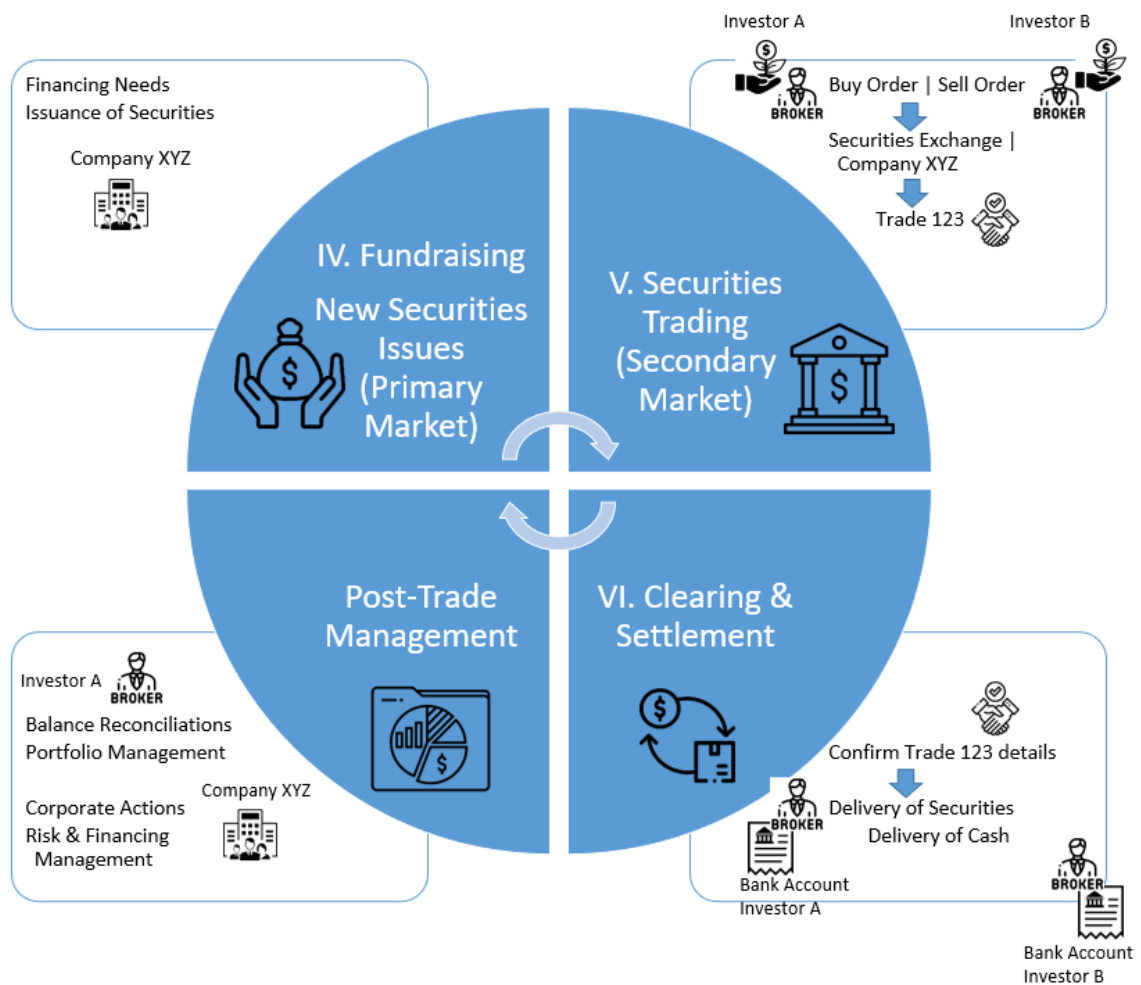


Figure 3. Representation of investment banking use cases

When a company or a government has financing needs, they can fulfill them in the financial markets with the help of investment banks, who prepare the operation and contact potential investors in the primary market.

After the securities are issued and set up, they can be traded between investors in the secondary market. Investment banks, and brokers provide that service, allowing investors to access markets to trade, either in public exchanges or through over-the-counter banking networks. They manage the customer's trading intentions and whenever an order finds a match, we have a new trade and a new quote for that security.

The trade lifecycle is not finished here. Afterward, it is essential to confirm all the details of the trade between the parties, and a few days later to complete the exchange of the cash and the securities to the customers' accounts.

After the trade is complete it becomes a position in an investor's portfolio, that will be managed as it will be subject to corporate events (dividends, splits...). On the company or government's side, its day-to-day operations affect the value of its securities and can lead to new financing needs, and so on.

Overall, investment banking remains an important part of the global financial system, providing critical services that help companies and governments raise capital, grow their businesses and services, and achieve their goals.

4.3. Use Cases Business Models

For the presentation of the use cases considered for this study, it is provided a description of each, an estimation of the total addressable market and growth prospects, and a detailed representation of the business model canvas (Osterwalder, A., & Pigneur, Y., 2010).

Business model canvas provides a visual framework consisting of nine building blocks that capture the key aspects of a business model, including customer segments, value proposition, channels, customer relationships, revenue streams, key activities, key resources, key partnerships, and cost structure.

I. KYC and Fraud Prevention

KYC (Know Your Customer) and Fraud Prevention are essential banking services that aim to prevent financial crimes such as money laundering and terrorist financing.

According to a report by Grand View Research, the global KYC market size was valued at \$491.9 million in 2020 and is expected to grow at a compound annual growth rate (CAGR) of 14.2% from 2021 to 2028. Additionally, the global AML software market size was valued at \$1.06 billion in 2020 and is expected to grow at a CAGR of 15.5% from 2021 to 2028, according to a report by Allied Market Research.

Moreover, with the increasing adoption of digital technologies and the rise of online transactions, the demand for customer KYC and AML services is expected to grow even further in the coming years.

The generic business model of KYC and Fraud Prevention services can be summarized in a business model canvas, as follow:

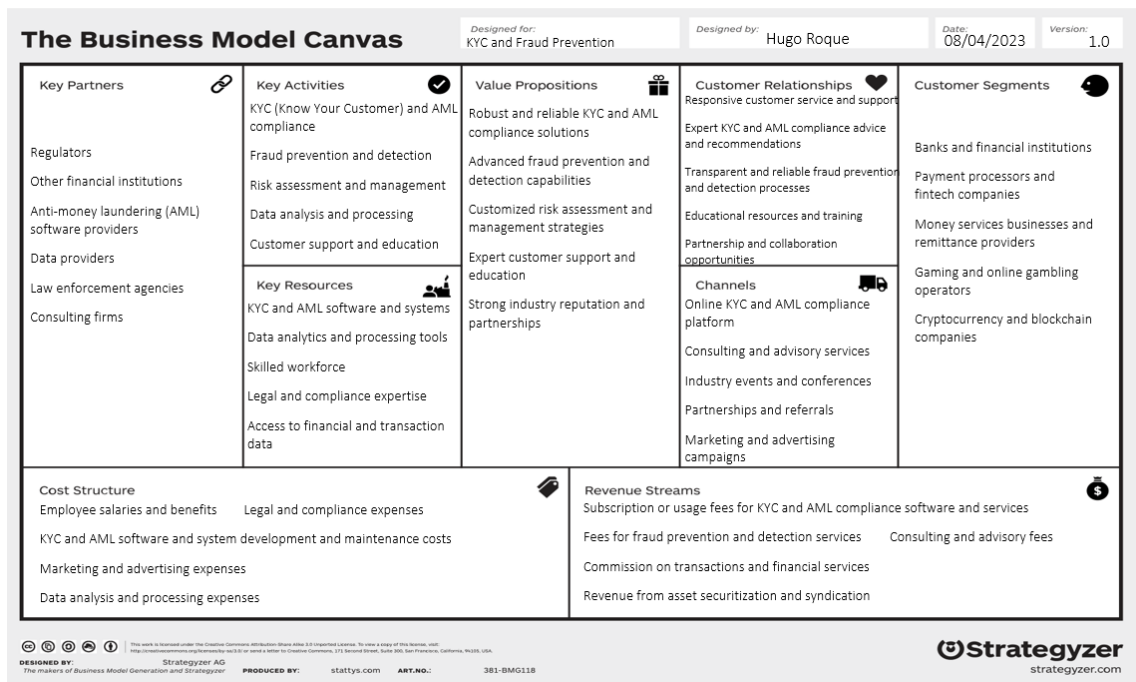


Figure 4. KYC and Fraud prevention business model canvas

II. Loans and Credit

Loans and credit banking services involve providing funds to borrowers for various purposes, such as purchasing a home, starting a business, or funding an education. Banks make money through interest and fees charged on these loans, and credit risk management is a key factor in the success of this business model.

The business model for loans and credit banking services typically involves generating revenue through interest on loans, as well as through fees for services such as loan origination and loan servicing. Banks may also earn revenue through the securitization of loans and other financial products.

The total addressable market for loans and credit banking services is substantial and is projected to continue to grow. According to a report by Allied Market Research, the global retail banking market is expected to reach USD 30.4 trillion by 2027, growing at a CAGR of 5.1% during the forecast period.

The generic business model of Loans and Credit services can be summarized in a business model canvas, as follow:

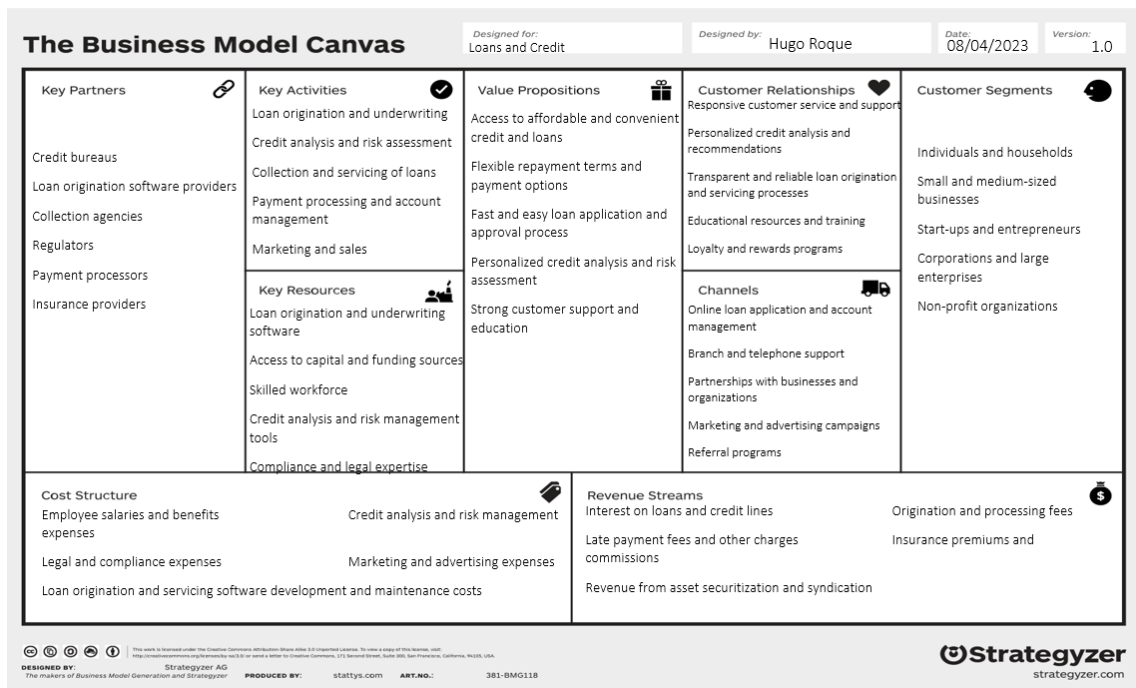


Figure 5. Loans and Credit business model canvas

III. Payments

Banking payment services refer to the various methods and systems that enable individuals and businesses to transfer funds from one account to another. These services include wire transfers, automated clearing house (ACH) payments, credit and debit card transactions, mobile payments, and peer-to-peer (P2P) payment services.

The business model of banking payment services typically involves four key components: payment processing, payment clearing, payment settlement, and revenue generation. Payment processing involves the initial authorization and authentication of a payment request. Payment clearing involves the verification of available funds and the transmission of the payment instructions to the recipient's bank. Payment settlement involves the transfer of funds from the sender's account to the recipient's account. Revenue generation involves the collection of fees for payment processing and other value-added services.

Banks and financial institutions typically generate revenue from payment services through transaction fees, interchange fees, and net interest margins. Transaction fees are charged to merchants and businesses for processing payments, while interchange fees are charged to the merchant's bank by the card-issuing bank for facilitating the transaction. Net interest margin is the difference between the interest earned on deposits and the interest paid on loans used to fund payment services.

The global banking payment services market size was valued at USD 1.64 trillion in 2020 and is expected to reach USD 2.74 trillion by 2028, growing at a compound annual growth rate (CAGR) of 6.9% from 2021 to 2028 (Grand View Research, 2021). This growth is driven by the increasing adoption of mobile payment services, the rise of e-commerce, and the growing demand for real-time payment solutions.

The generic business model of Payments services can be summarized in a business model canvas, as follows:

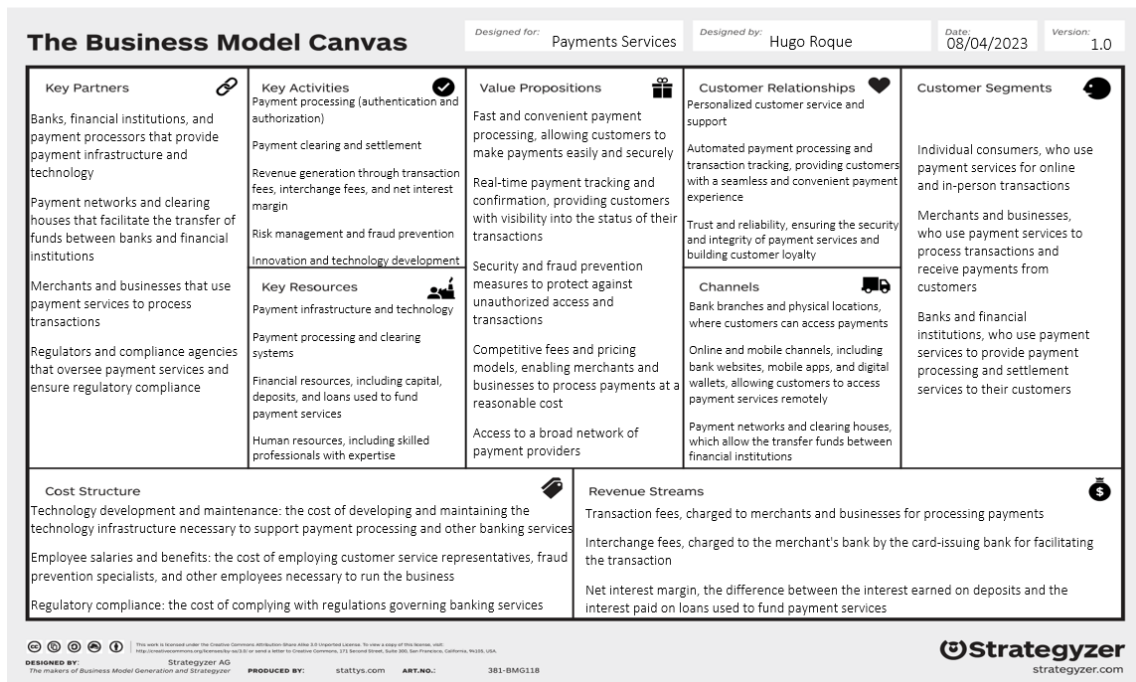


Figure 6. Payment's business model canvas

IV. Fundraising

The company fundraising industry encompasses a range of activities and services designed to help businesses raise capital to finance their operations, investments, and growth. The industry is made up of a variety of players, including investment banks, private equity firms, venture capital firms, and crowdfunding platforms.

Investment banks are key players in the fundraising industry, providing underwriting services for initial public offerings (IPOs), debt offerings, and other securities offerings. Investment banks typically work with larger, more established companies that have a track record of financial performance and a well-known brand.

Private equity firms and venture capital firms are other important player in the fundraising industry, providing equity financing to start-up and growth-stage companies that are not yet profitable or have limited financial history. Private equity firms typically focus on mature, established businesses, while venture capital firms focus on early-stage companies with high growth potential.

Crowdfunding platforms are a newer entrant into the fundraising industry, offering a way for businesses to raise capital through small contributions from a large number of individual investors. Crowdfunding platforms can be particularly attractive for start-ups and small businesses that may have difficulty accessing traditional forms of financing.

According to a report by Pitchbook, global venture capital investment reached a record \$304 billion in 2021, and private equity fundraising totaled \$719 billion in the same year. These figures provide some indication of the size of the market for equity financing provided by private equity and venture capital firms.

In addition, the crowdfunding industry has seen significant growth in recent years, with some estimates suggesting that the global crowdfunding market could reach \$300 billion by 2025. This includes both equity-based crowdfunding and other forms of crowdfunding such as rewards-based and donation-based crowdfunding.

Moreover, the investment banking industry provides a wide range of fundraising services, including IPOs, debt offerings, and mergers and acquisitions. According to a report by Thomson Reuters, global investment banking fees totaled \$117.1 billion in 2021, with equity underwriting and debt underwriting accounting for a significant portion of these fees.

Therefore, the TAM for the fundraising industry could be estimated to be in the trillions of dollars, depending on the specific markets and customer segments targeted by different players in the industry.

The generic business model of Fundraising services can be summarized in a business model canvas, as follow:

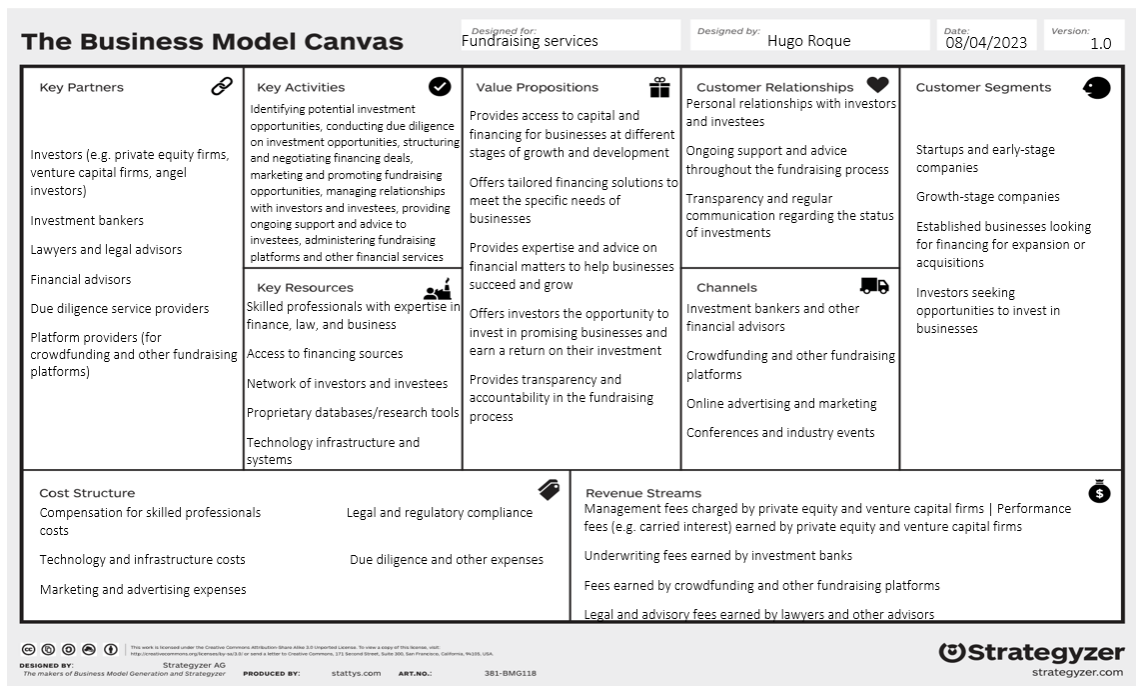


Figure 7. Fundraising business model canvas

V. Securities

Securities trading is a banking service that involves the buying and selling of financial securities, such as stocks, bonds, and derivatives. Securities trading services are typically provided by investment banks, which offer access to various trading platforms and investment products.

The business model for securities trading banking services typically involves generating revenue through commissions on trades, as well as through underwriting fees and investment banking services. Investment banks may also earn revenue by providing market-making services and through proprietary trading.

According to a report by Market Research Future, the global securities brokerage market is expected to reach USD 62.9 billion by 2025, growing at a CAGR of 4.5% during the forecast period.

According to a report by the World Federation of Exchanges (WFE), the total market capitalization of listed companies worldwide was approximately \$98.4 trillion as of the end of 2021. This includes equity securities, such as common stocks, and other types of securities, such as bonds and derivatives.

The generic business model of Securities can be summarized in a business model canvas, as follow:

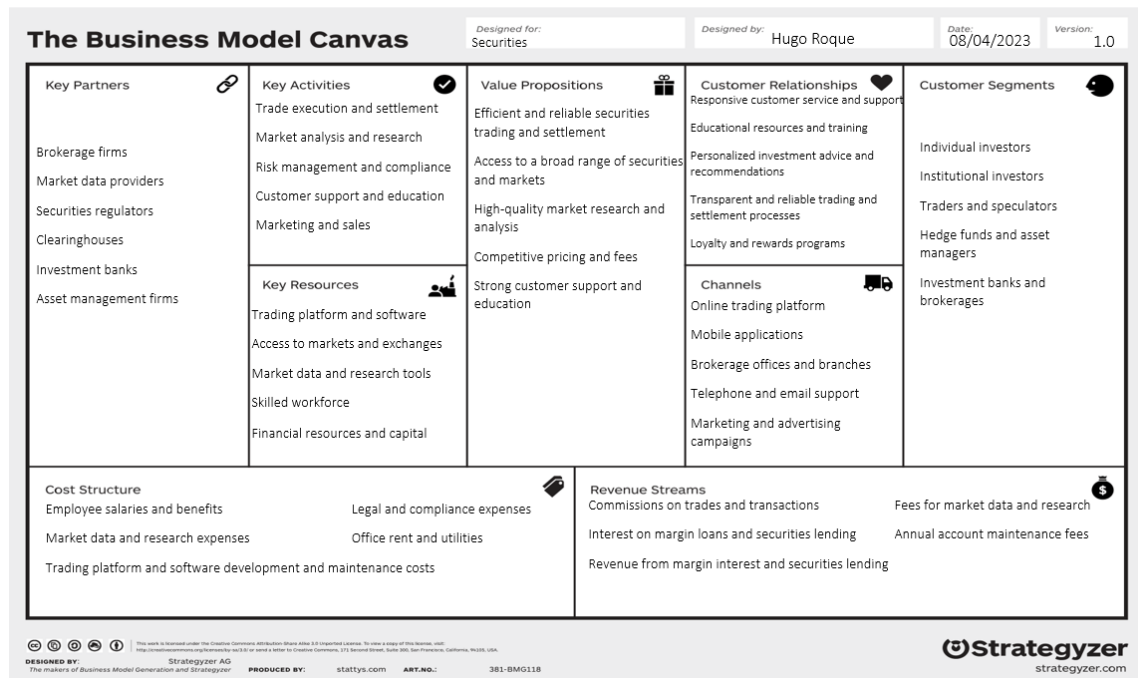


Figure 8. Securities business model canvas

VI. Clearing and Settlement Systems

Clearing and settlement of securities banking services are crucial for ensuring the efficient and secure transfer of ownership of securities traded on exchanges. The process involves the reconciliation of buy and sell orders, the transfer of securities ownership, and the transfer of funds between parties.

The business model for clearing and settlement services typically involves charging fees for each transaction processed. These fees are usually calculated as a percentage of the value of the transaction, with higher fees for larger transactions. Additionally, some clearing and settlement providers may offer additional value-added services, such as risk management and trade reporting, which can also generate revenue.

The total addressable market for clearing and settlement services in the securities banking industry is difficult to estimate precisely, as it is dependent on the volume and value of securities trades on exchanges. However, according to a report by MarketsandMarkets, the global securities clearing and settlement market size was valued at USD 70.17 billion in 2020

and is expected to reach USD 98.79 billion by 2026, growing at a CAGR of 5.5% during the forecast period.

The generic business model of Clearing and Settlement Systems services can be summarized in a business model canvas, as follow:

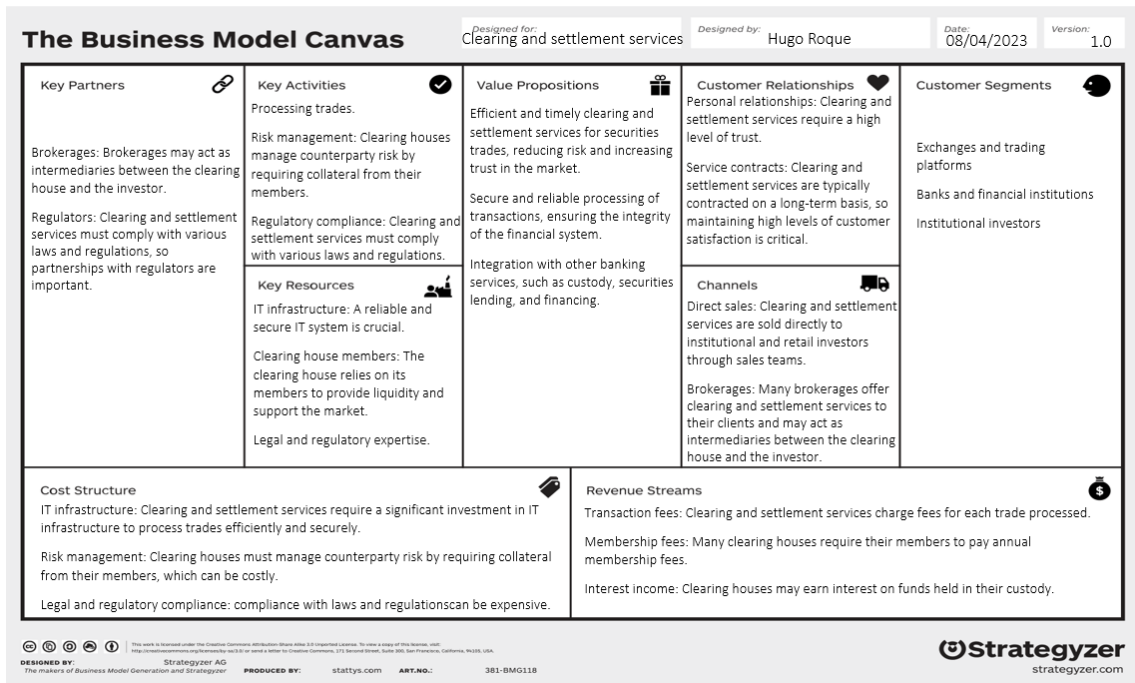


Figure 9. Clearing and settlement business model canvas

VII. Trade Finance

Trade finance is a banking service that facilitates international trade transactions by providing financing, risk mitigation, and other services. The business model for trade finance typically involves generating revenue through interest on loans and fees for services such as letters of credit, guarantees, and export finance.

According to a report by the International Chamber of Commerce (ICC), the global trade finance market was estimated to be around \$20 trillion in 2019. This includes both traditional trade finance products such as letters of credit and guarantees, as well as newer digital trade finance solutions.

The potential customer base for trade finance includes exporters and importers engaged in international trade, small and medium-sized enterprises (SMEs) seeking trade finance solutions, and multinational corporations with complex trade finance needs.

The generic business model of Trade Finance services can be summarized in a business model canvas, as follow:

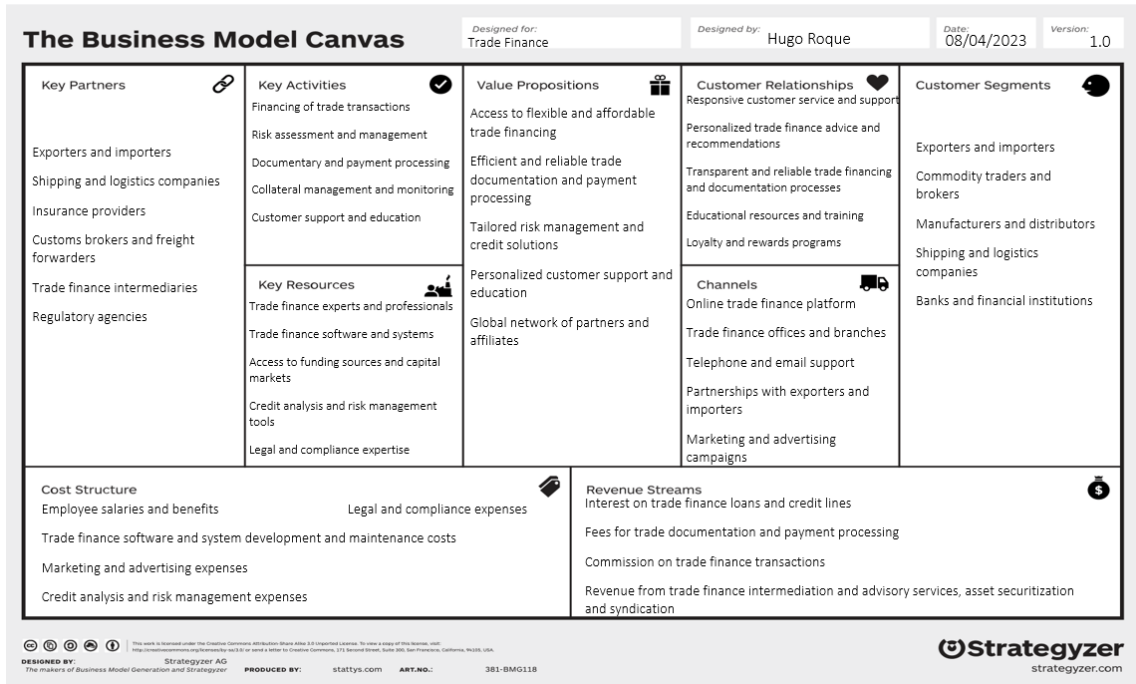


Figure 10. Trade finance business model canvas

5. Qualitative Interviews

The research's objective from the qualitative interviews is to gather insights from experts in banking businesses and Blockchain implementations on the most relevant elements to take into account for this technology to be adopted by the market.

5.1. Units of Analysis

The unit of analysis refers to the specific entity or level of analysis that the researcher focuses on while conducting their study. It is the primary subject of investigation or the level at which data is collected and analyzed to answer the research questions or objectives.

To understand how can banking uses cases make the best use of Blockchain technology, we need to gather insight on two sides: on the customer's profiles, their pains, needs; and on the possible product/service value map, which are the possible solutions to those problems, involving Blockchain adoption. Therefore, there was a need to interview banking experts on legacy banking services and also experts on Blockchain adoption for the banking industry.

Having defined the banking use cases to analyze from traditional banking but from investment banking, it is also crucial to interview experts from both areas. Therefore, the units of analysis will cover these two important criteria: customer profile (pains, gains, jobs to be done) vs value map (product or service solutions) and traditional banking use cases vs investment banking use cases:

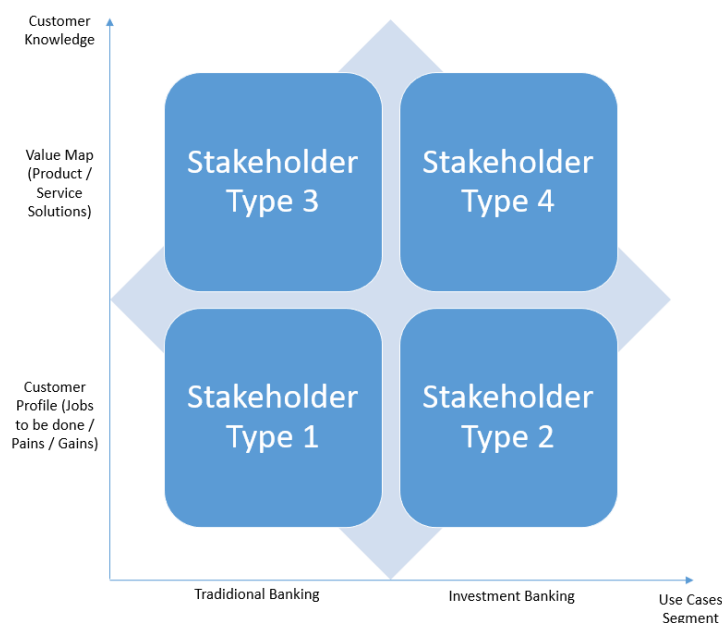


Figure 11. Types of stakeholders

From the intersection of these segments, it was defined the 4 types of Stakeholders to focus on as units of analysis selected for the thematic analysis.

5.2. Data Collection

Data was collected through online semi-structured interviews, which combine elements of both structured and unstructured interviews, providing a flexible framework for gathering rich data while maintaining some level of standardization (Rubin, H. J., & Rubin, I. S., 2011).

The interviews were conducted online with middle/top managers of Portuguese and International banks, and IT companies, after obtaining informed consent. They took, on average, 40 minutes.

The interviews were based on two scripts (Annex 2), for traditional banking experts and investment banking experts.

Six interviews were conducted with the following experts:

Table 4. Experts interviewed

| Stakeholder Group | Expert | Area of Expertise | Country |
|--------------------------|-----------------------------------------------------|-------------------------------------------|----------|
| Stakeholder Type 1 | A - Business Manager of Commercial Banking Network | Private and business banking | Portugal |
| Stakeholder Type 2 | B - Asset Manager | Asset management | Portugal |
| Stakeholder Type 3 and 4 | C – Technology Promoter and Consultant | Blockchain trends | Portugal |
| Stakeholder Type 3 and 4 | D – CEO of Blockchain Solutions Company | Blockchain development and implementation | UK |
| Stakeholder Type 3 and 4 | E – Head of Blockchain in Multination Banking Group | Blockchain innovation | France |
| Stakeholder Type 3 and 4 | F – President of Blockchain Association | Blockchain trends | Portugal |

Stakeholders 1 and 2 – The Customer Profile

Two of the experts are individuals with huge experience working in legacy banking services in either traditional banking (Interviewee A | Stakeholder Type 1) or investment banking (Interviewee B | Stakeholder Type 2). For these experts, it was used script A in Annex 2.

Script A focuses on questions regarding customers' challenges, their pains, the customer experience and how banks are working to improve it, and the vision for banking in the future.

Stakeholders 3 and 4 – The Product/Service Solution

Four experts possessed knowledge in more than one Stakeholder type group, namely groups 3 and 4, meaning that these experts have the knowledge and understanding of the use cases of both traditional banking and investment banking and they have expertise on the solutions for the adoption of Blockchain for these use cases. For these, it was used the script B in Annex 2.

Script B focuses on understanding which use cases can be improved with the adoption of Blockchain, their main benefits and limitations, the estimated impacts on business models, and their main barriers and challenges for the adoption.

After the interviews were made, they were transcribed and analyzed.

6. Discussion

To proceed to the analysis of the information collected from the interviews, a review of the interviews was performed, highlighting the relevant insights that were provided.

Evidence: Expert A

Expert A has a banking experience of 20 years, working with both individuals and companies. In the last 4 years, he manages a team of business managers on a commercial network, providing banking services to companies in the area of the north of Portugal.

The interview with Expert A (Stakeholder Type 1) focused on the challenges faced by banks in offering payment services, loans, and credit services, and customer validation, the traditional banking use cases.

Expert A emphasized the importance of trust in the customer identification process in credit transactions and account openings. He stated, *“We have a series of documents to validate, such as its income, its wealth...”* There is a recurring need to update customers’ information and request additional documentation whenever a new credit analysis is requested, which is troublesome.

Regarding payments, Expert A noted that advancements have been made, particularly within the eurozone, enabling faster transactions. However, he pointed out that international payments, especially those conducted through systems like Swift, can still pose challenges. Expert A stated, *“I don't see any major difficulties for the banks (within the eurozone), anyone now transfers instantly and now things are immediate, payments are made in seconds.”* However, he acknowledged that global payments, especially those involving Swift, can experience delays.

Expert A also discussed the impact of these challenges on the consumer experience. He mentioned that customers can become dissatisfied with delays, the time required for credit analysis, and the overall process. He expressed the need for faster and more automated information transfer, stating, *“If there was something that would allow this information to be passed on faster, in a more automated way, the customer experience would be much better.”* Expert A highlighted the potential for automation and data validation to improve the customer experience, particularly in invoice factoring and contract formalization.

Regarding changes in customer behavior, Expert A observed a significant shift towards mobile banking and online transactions, particularly among the younger generations. He mentioned that customers increasingly expect automation and immediate responses. Expert A stated, *“People are increasingly looking for this way of working, that is, things are much more automated.”*

He also highlighted the evolving role of banks, with a focus on automating processes to reduce administrative burdens and enhance the commercial aspect of relationships.

Looking ahead, Expert A predicted further simplification and acceleration of processes such as credit approvals, account openings, and formalizations. He envisioned a future where digital banking becomes the norm but still maintains a physical presence for personalized interactions. Expert A stated, *“I think the future of the Bank... will be like this. That is, digital banks, but with maintaining a physical presence.”* He emphasized the importance of the relationship between banks and customers and suggested that fully digital banks might be limited in their ability to provide comprehensive services.

Evidence: Expert B

Expert B has a brokerage and asset management experience of 15 years, working as a team manager with individuals and institutional customers, with intimate knowledge of investment banking use cases.

The interview with Expert B (Stakeholder Type 2) focused on the challenges faced by investment banks offering fundraising services, securities trading, clearing, and settlement services, and also trade finance services.

Expert B started the interview by talking about the challenges faced by banks and stated that One of the biggest challenges for banks is managing the high costs and fees associated with their services. He also highlighted the impact of regulatory compliance, saying, *“Regulatory compliance and documentation requirements pose a significant challenge for banks. Meeting these obligations can be time-consuming and complex.”*

When asked about common complaints or pain points that customers have, Expert B highlighted, that *“Customers frequently express their dissatisfaction with the excessive fees charged by banks.”* He also pointed out that the extensive regulatory requirements and documentation processes are often seen as cumbersome and time-consuming by customers, particularly in cases such as Trade Finance. Additionally, he mentioned that customers find it challenging to navigate the complex financial landscape. They want more transparency and a better understanding of the costs and risks involved in their banking transactions. Trust is key in the relationship between banks and customers.

Regarding changes in customer behavior and preferences, Expert B noted that customers are becoming more cost-conscious and demanding transparency in banking services. They

want to ensure they are getting value for their money. He further added, *“Digital accessibility and seamless user experiences have become essential for customers. They expect convenient, user-friendly banking solutions that meet their needs.”*

In response to addressing these challenges and improving customer experience, Expert B explained that investing in technological advancements has been a key focus for banks. They aim to enhance digital interfaces and provide convenient self-service options for customers. Additionally, he mentioned, *“Banks are striving to improve transparency, educate customers, and simplify complex financial processes to enhance the overall customer experience.”*

Looking ahead, when asked about the future of banking services, Expert B shared his insights, stating, *“In the next 5-10 years, we can expect banking services to continue evolving. Technology will play a significant role in transforming the customer experience, with advancements in digital banking, artificial intelligence, and personalized services. Customers will likely benefit from improved accessibility, seamless transactions, and tailored financial solutions.”*

Evidence: Expert C

Expert C is a secretary and found member of a Portuguese institute that looks to highlight and promote new technologies and in particular Blockchain. He has experience in innovation roles and also with Blockchain.

The interview with Expert C (Stakeholder Type 3 and 4) focused on the potential of the adoption of Blockchain in traditional and investment banking use cases and also its possible limitations.

Regarding the areas where Blockchain can bring disruptive power and immediate impact, Expert C emphasized the investment banking sector. He noted that while finance is already digitized to a large extent, there are still processes within the industry that are outdated and require optimization. Blockchain has the potential to eliminate redundancies, reduce costs, and remove intermediaries in the financial system. Expert C highlighted the dematerialization of assets and the digitization of processes as key areas where Blockchain can bring value. As Expert C stated, *“Undoubtedly in the area of finance because, nowadays, finance is already digitized, unlike other areas where it is necessary to digitize... And that right there undermines the way Blockchain brings value.”*

Expert C discussed the tokenization of securities and financial assets as one example of the potential impact of Blockchain technology. He also mentioned trade finance and how

Blockchain can optimize supply chains and streamline credit distribution. He highlighted the inefficiencies in traditional processes, such as the need for physical letters of credit and manual authorization, which can be replaced with digital signatures and streamlined approval processes. As Expert C pointed out, *“There can be a lot of savings in the asset authorization area.”* He also mentioned the growing interest in crypto assets among younger generations, as they offer more instantaneous trading platforms and better user experiences. According to Expert C, *“Nowadays people do not deal so much with traditional assets... They prefer to trade crypto assets because it's much more instantaneous and the platforms are better and there's nothing to stop it.”*

The interview touched on the Dlt Pilot Regime introduced by the European Union to modernize stock market infrastructure and provide benefits for platforms looking to start these markets. The regime aims to improve liquidity in the SME sector and create securities markets using Blockchain technology. While Expert C expressed some skepticism about the potential impact, he acknowledged the initiative as an interesting development that demonstrates confidence in Blockchain technology. In Expert C's words, *“The Dlt pilot can help change the regime... It may eventually lower costs.”*

In terms of the impact on banks' business models, the discussion revolved around the digital transformation brought about by Blockchain. Expert C referred to a logic tree that determines where it makes sense to use Blockchain in a business context. He highlighted that the level of trust within a business system plays a crucial role in determining the suitability of Blockchain. Private Blockchains, involving a consortium of participants with established trust, were mentioned as a possible solution in certain cases. Expert C explained, *“Blockchain is still a database... and they don't need a database that they don't have to trust, which is the definition of a Blockchain.”* He further noted, *“It (private Blockchains) can be interesting in some contexts, but it is not as transformative as, for example, the use of Blockchain in the public system and public infrastructure.”*

Overall, the interview provided insights into the potential of Blockchain technology in transforming the banking industry. While there are challenges and considerations regarding the adoption of Blockchain, particularly in the context of business models and trust dynamics, Expert C acknowledged the value that Blockchain brings in optimizing processes, reducing costs, and improving efficiency in finance and other areas of the banking sector.

Evidence: Expert D

Expert D is the Head of Blockchain of a multinational banking group. He leads Blockchain implementation projects and investments in startups with the potential to bring Blockchain adoption to the group.

The interview with Expert D (Stakeholder Type 3 and 4) focused on the potential of the adoption of Blockchain in traditional and investment banking use cases and also its possible limitations.

In the interview, Expert D discusses three main angles or streams through which his banking group is exploring Blockchain technology. He states, *“We have three major angles, which are related to the value we can capture from Blockchain. The first angle is about operational efficiency and the digitization of complex business processes.”* He emphasizes the potential of Blockchain to improve transparency and efficiency, saying, *“Blockchain will improve transparency and solve fraud issues,”* and mentions its applicability in multiparty processes, stating, *“We have seen benefits in the improvement of efficiency in multiparty processes.”*

The second angle focuses on the migration of financial markets toward Blockchain-based infrastructures. Expert D mentions his group’s interest in the native issuance of securities on the Blockchain and asset tokenization. He also highlights the exploration of central bank digital currencies (CBDCs) or commercial bank digital currencies (CBDCs) for settlement efficiency, stating, *“We are looking into the issuance of digital assets. We are looking into tokens, tokenizing assets.”* He adds, *“We are also exploring CBDCs or CBDC-like systems for settlement.”*

Regarding crypto as a new asset class, Expert D acknowledges the regulatory developments in Europe and France, stating, *“The regulatory framework is becoming clearer in Europe. We can now, as a regulated actor, provide services related to cryptocurrencies.”* He mentions his group's exploration of offering crypto-related services to clients, saying, *“We have started offering cryptocurrency services, such as custody, buying, and selling,”* and considers it as an alternative investment asset class.

Expert D discusses the potential use cases of Blockchain in the banking industry and acknowledges its limitations. He states, *“The use case for retail payments is not that strong,”* referring to the availability of existing digital payment means. He suggests that Blockchain may be more beneficial in wholesale interbank payments and securities settlement, stating, *“We see that Blockchain has a stronger case in wholesale interbank payments, in securities settlement.”*

Regarding the impact of adopting Blockchain on banks' business models, Expert D acknowledges the initial defensive view of banks but highlights the protective nature of

regulations, stating, *“When we talk to the regulators, they say, ‘You are the regulated players, you will apply for licenses, and you will use the new regime’.”* He suggests that banks will be forced to embrace innovation and connect to new infrastructures to avoid losing market share, saying, *“So, in a way, it’s defensive, but it’s also offensive. If we don’t connect to this infrastructure, we lose our customers.”*

Expert D also acknowledges the challenges of market participants disrupting themselves and the dilemma faced by existing market infrastructure operators. He mentions the Swiss Six group and the SDX platform as forward-looking examples, stating, *“The Swiss have the SDX platform, which is a fully regulated exchange platform. They are taking a very forward-looking view on this.”* He notes the difficulty of investing in new infrastructure while maintaining the old one, saying, *“This is the big dilemma of existing market infrastructure operators: should they invest in the new one while still running the old one?”*

Overall, the interview with Expert D provides insights into a multinational group’s exploration of Blockchain technology in the banking industry.

Evidence: Expert E

Expert E is the CEO of a company that provides Blockchain solutions to different industries, including the Banking industry. He has been the founder of several businesses and also has a background as an IT solutions architect

The interview with Expert E (Stakeholder Type 3 and 4) focused on the potential of the adoption of Blockchain in traditional and investment banking use cases and also its possible limitations.

In the interview, Expert E shares insights on the potential impacts of Blockchain on banking business models. When discussing the potential of Blockchain to improve banking use cases, Expert E expresses skepticism about the potential for improvement in KYC processes, stating, *“The potential for Blockchain to improve that process is very limited.”* However, he sees significant disruption potential in decentralized finance (DeFi) for loans and payments. He states, *“As we think about Blockchain and DeFi, we can think of different use cases... where the potential for disruption is very high.”*

Regarding loans, Expert E emphasizes the potential of Blockchain and smart contracts, stating, *“Using smart contracts, completely defining the life of the loan and its terms and not needing to make maintenance again on it, is huge.”* He also highlights the potential for simplification and

removal of intermediaries in payments, stating, *“Of course, you can remove a lot of intermediaries in the process... those will all be wins for payments.”*

When discussing the potential impact on banking business models, Expert E predicts a winner-takes-all scenario, stating, *“A few big players will have the technology and provide the service for many, many, many users.”*

On the opposite way, he also envisions increased competition and a more competitive business model in the case of loans and credits, stating, *“Banks start not to compete based on their brand, but they start competing only by price... moving the business model into a more competitive business model due to Blockchain.”*

Regarding barriers to Blockchain adoption, Expert E highlights the conservative nature of banks and the need for a clean slate approach, stating, *“The project... needs an attitude to rethink the infrastructure and to start from a clean slate.”* He further acknowledges the regulatory limitations, stating, *“Regulators are very tight with the banks... they tend to protect their activity a lot and do not allow new entrants.”*

In terms of risks and challenges, Expert E notes the technology's maturity and stability, stating, *“I see a technology that is maturing... I don't see hurdles there.”* However, he highlights regulatory limitations and complacency between central banks and traditional banks as potential obstacles to widespread adoption, stating, *“It will be a limitation for sure, at least in the short term.”*

Overall, the interview with Expert E provides insights into the potential impacts of Blockchain on banking business models. His quotes shed light on the limited potential for improvement in KYC processes, the disruptive potential in DeFi, the benefits of smart contracts in loans and payments, the potential winner-takes-all scenario, the increased competition in the loan and credit space, and the challenges associated with regulatory limitations and complacency.

Evidence: Expert F

Expert F is the President of a Blockchain association whose main objective is the development of the Blockchain ecosystem. He is also a consultant, a teacher, and an advisor to the World Economic Forum.

The interview with Expert F (Stakeholder Type 3 and 4) focused on the potential of the adoption of Blockchain in traditional and investment banking use cases and also its possible limitations.

Expert F highlighted the prioritization of KYC and fraud prevention, clearing and settlement, and trade finance as potential areas for Blockchain adoption due to market demand, technological feasibility, and strategic alignment for banks. However, the expert expressed less enthusiasm for payments and fundraising use cases.

Expert F emphasized the importance of assessing fit, stating, “*Banking institutions should evaluate the applicability of Blockchain to specific use cases, such as KYC and fraud prevention, and trade finance.*” The interviewer stressed the need for a thorough analysis with specific tools, as each use case has different requirements and potential benefits.

Addressing challenges was another crucial consideration discussed in the interview. Expert F stated, “*Banks must navigate challenges such as scalability, interoperability, and regulatory frameworks.*” It was acknowledged that solutions to these challenges are continuously evolving, and collaboration with industry players is crucial to drive innovation and establish standards.

ROI assessment was highlighted as a critical factor in evaluating Blockchain adoption. Expert F noted, “*Factors such as revenue potential, cost savings, and profitability should be considered to ensure the benefits outweigh the implementation costs.*” Additionally, it was emphasized that relying solely on ROI, NPV, and IRR analysis is insufficient to determine the success of a Blockchain project.

The broader impact and sustainability of Blockchain adoption were also addressed in the interview. Expert F stated, “*Also consider the positive impact on customers, society, and the environment.*” It was emphasized that evaluating the technology's sustainability and ethical aspects is an important criterion, especially for impact investors. The low carbon footprint impact of new Layer 1 Blockchain solutions was specifically mentioned.

7. Interviews Learnings

Within the thematic analysis methodology, after revising the data, and gaining a comprehensive understanding of the content and context, important concepts, ideas, or patterns started to emerge. Grouping them allowed to form themes. These themes and sub-themes were developed and refined leading to the data interpretation concerning the research objectives. The most relevant findings were on the themes of: challenges of banking customers, Blockchain value propositions, prioritization of use cases for the adoption of Blockchain, factors leading to Blockchain adoption, business model and market structure dynamics, and European regulation developments.

7.1. Challenges of Banking Customers

The interviews with Stakeholder Type 1 (Expert A) and Stakeholder Type 2 (Expert B) were important to provide a view of the pains, problems, and needs of customers of traditional banking services and investment banking services.

Expert A and Expert B mention that delays in banking processes, due to validation

procedures, such as in a loan request or a trade finance operation, lead to customer dissatisfaction. Using legacy systems is also a cause for issues with customers.

Both Expert A and Expert B emphasize that bureaucratic processes such as customer identification and validation, regulatory compliance, and documentation requirements tend to pose significant challenges for banks in their relation to customers.

Expert A discusses the advancements in payment services within the eurozone, enabling faster transactions. However, international payments, especially through systems like Swift, payment still pose challenges and can experience delays.

Expert B mentions that excessive fees charged by investment banks are a pain for customers and that they want more transparency and a better understanding of the costs and risks involved in their banking transactions. Both agree that trust is a central element of the relationship between banks and customers. Increasing automation, immediate responses, and user-friendly banking solutions should enhance the customer experience.

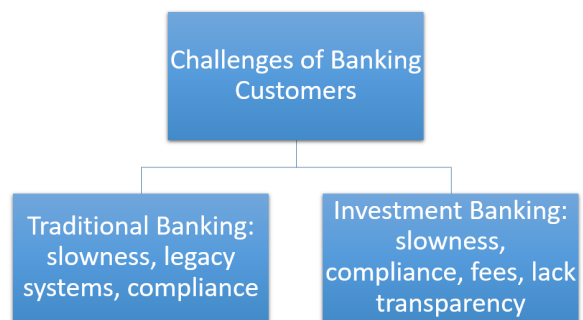


Figure 12. Theme Analysis: challenges banking customers

7.2. Blockchain Value Propositions

With the findings of the literature review on the benefits and challenges of Blockchain, the clear definition of the use cases

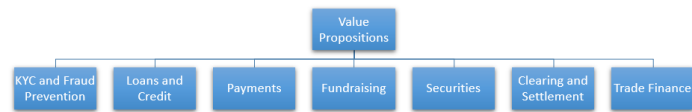


Figure 13. Thematic analysis: value propositions

and their business model analysis, and the validation from the data collected from these qualitative interviews, on both the customer profile (Stakeholders 1 and 2) and on the Blockchain solutions (Stakeholders 3 and 4), it is also important to provide a picture of what Blockchain characteristics can bring to empower the different use cases. Following a customer-centric approach, it is relevant to design value propositions for each use case, validated by experts' insights, so that we can make visualize a market fit between the features of the services and what customers look for in them.

To understand the elements to consider for this analysis, it is used the value proposition canvas (Osterwalder, A., Pigneur, Y et al, 2014), which focuses on the customer segment and the value they seek, and product or service offering and how it meets customer needs. It helps organizations align their value proposition with customer requirements, leading to more effective product development, marketing, and customer engagement strategies.

It consists of two main components: a customer profile and a value map. The customer profile focuses on understanding the customer segment. It includes identifying customer jobs, which are the tasks or problems customers are trying to accomplish or solve. It also involves identifying customer pains, which are the frustrations, challenges, or negative experiences customers encounter. Lastly, it captures customer gains, the desired outcomes. This was done with the support and validation of the insights of Stakeholders 1 and 2.

The value map focuses on the product or service offering. It involves identifying the products, features, or elements that alleviate customer pains and address customer gains. These are known as pain relievers and gain creators, respectively. Additionally, it captures the channels through which the value is delivered to customers and how companies interact with them. This was done mainly with the support of the insights of Stakeholders 3 and 4.

By mapping out the customer profile and value map, we can gain insights into how Blockchain-powered solutions align with customer needs and preferences. It helps them identify opportunities for improvement, innovation, and differentiation in their value proposition. It promotes a customer-centric approach to product development, marketing, and the overall business strategy.

I. KYC and Fraud Prevention

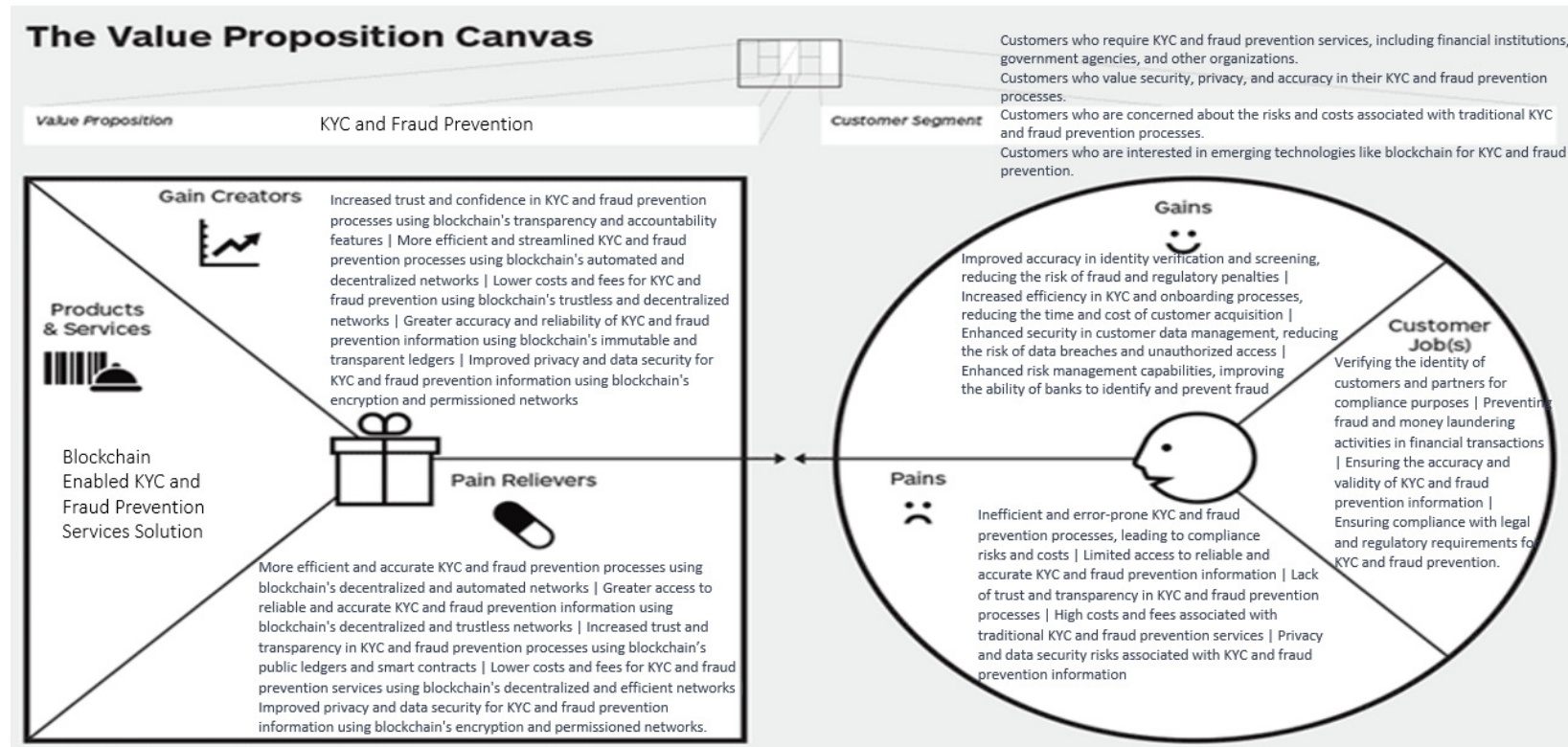


Figure 14. KYC and fraud prevention value proposition canvas

Value Proposition: The Blockchain-powered KYC and fraud prevention banking service offers enhanced security, streamlined compliance, real-time fraud detection, improved efficiency, customer trust, cost savings, and a seamless customer experience. This enables banks to strengthen their risk management capabilities, protect customer interests, and enhance their overall competitiveness in the market.

II. Loans and Credit

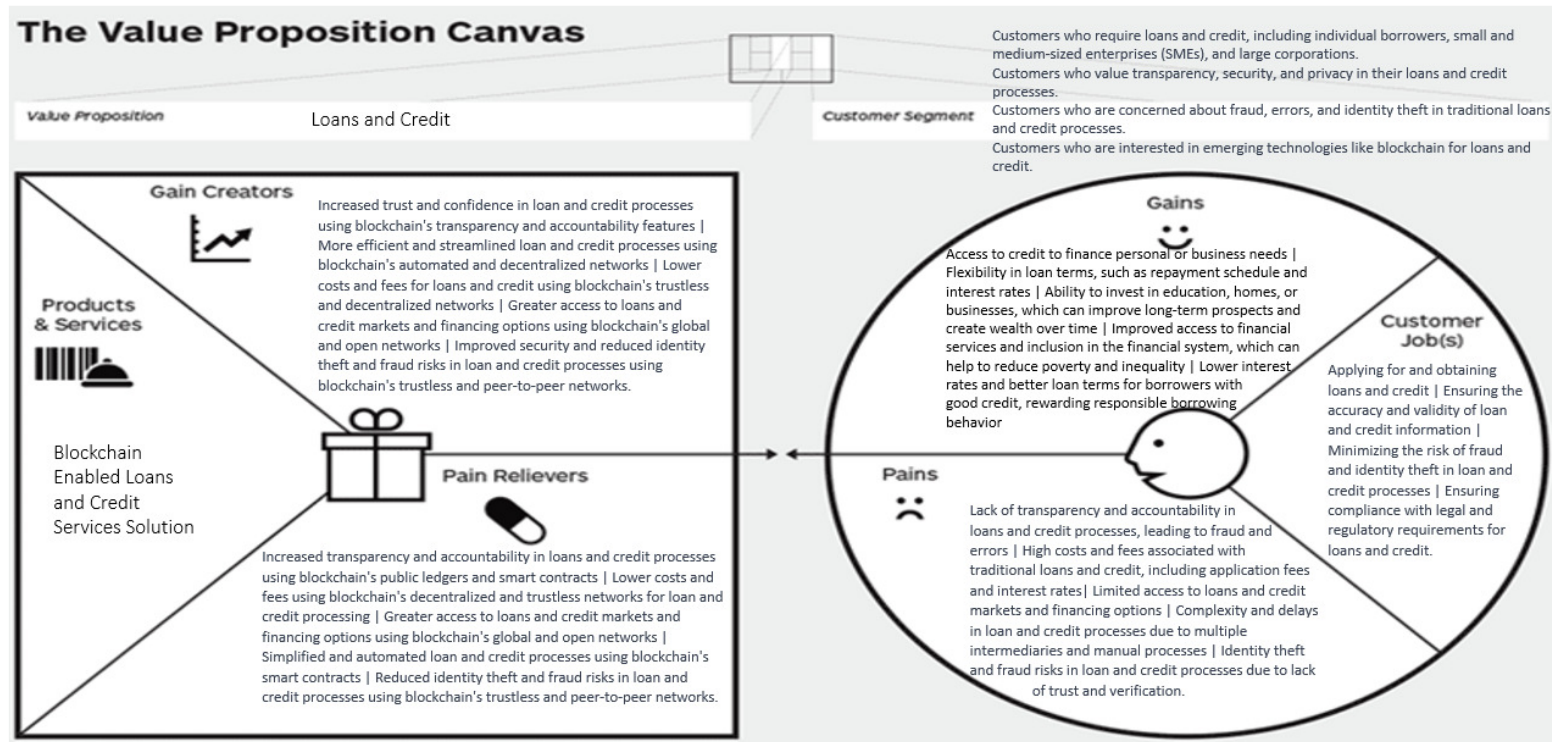


Figure 15. Loans and Credit value proposition canvas

Value Proposition: This Blockchain-powered banking service provides secure and efficient loans and credit solutions, leveraging the transparency and immutability of Blockchain to streamline processes, enhance security, and deliver a seamless customer experience. With Blockchain, we offer faster approvals, reduced paperwork, lower risk of fraud, and increased access to credit, empowering individuals and businesses to achieve their financial goals with confidence.

III. Payments

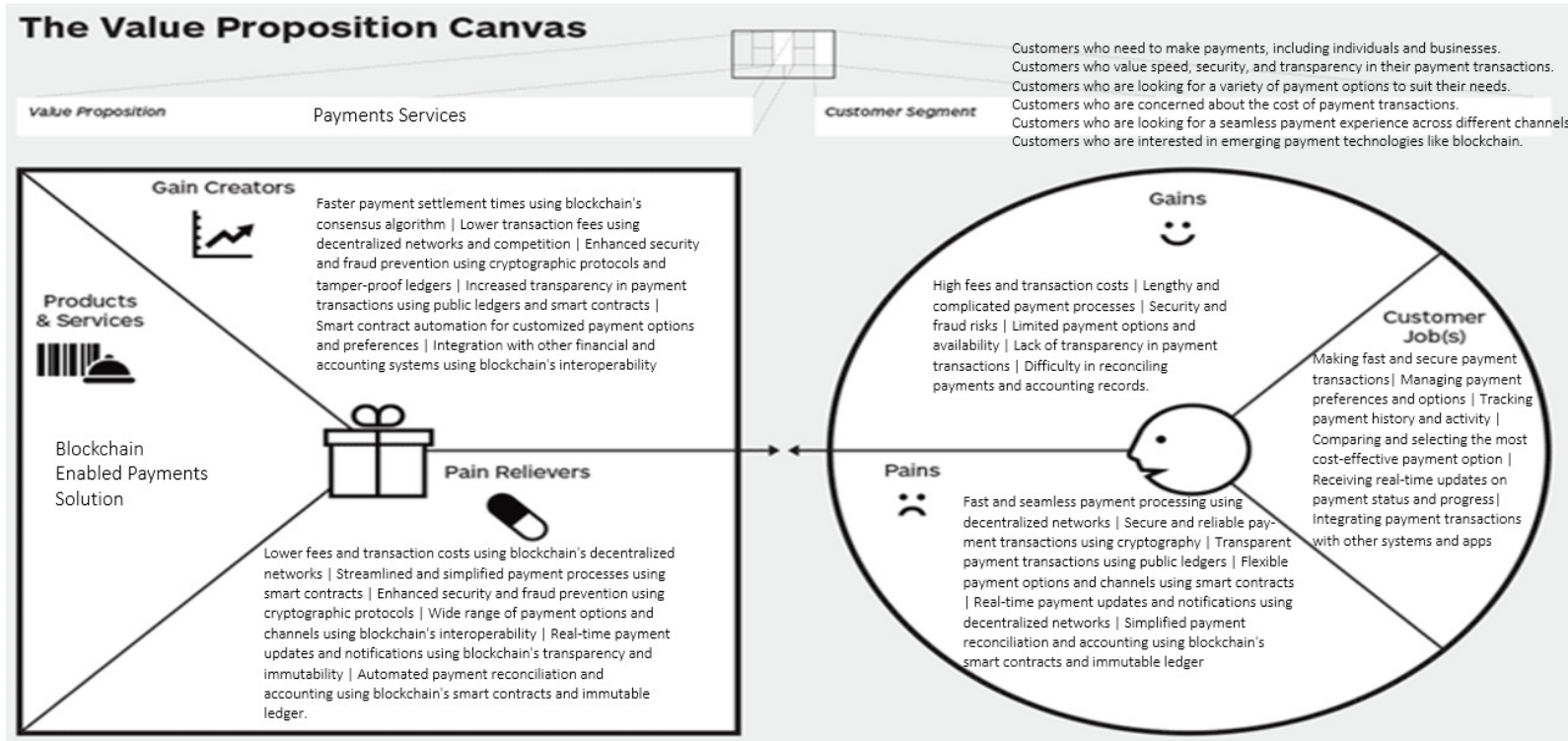


Figure 16. Payments value proposition canvas

Value Proposition: This Blockchain-powered banking service revolutionizes payments by offering secure, transparent, and seamless transactions. Leveraging the power of Blockchain, we eliminate intermediaries, reduce transaction costs, and ensure fast and reliable cross-border transfers. With enhanced privacy protection and real-time settlement, our solution empowers individuals and businesses to transact with confidence, opening up new possibilities for global commerce and financial inclusion.

IV. Fundraising

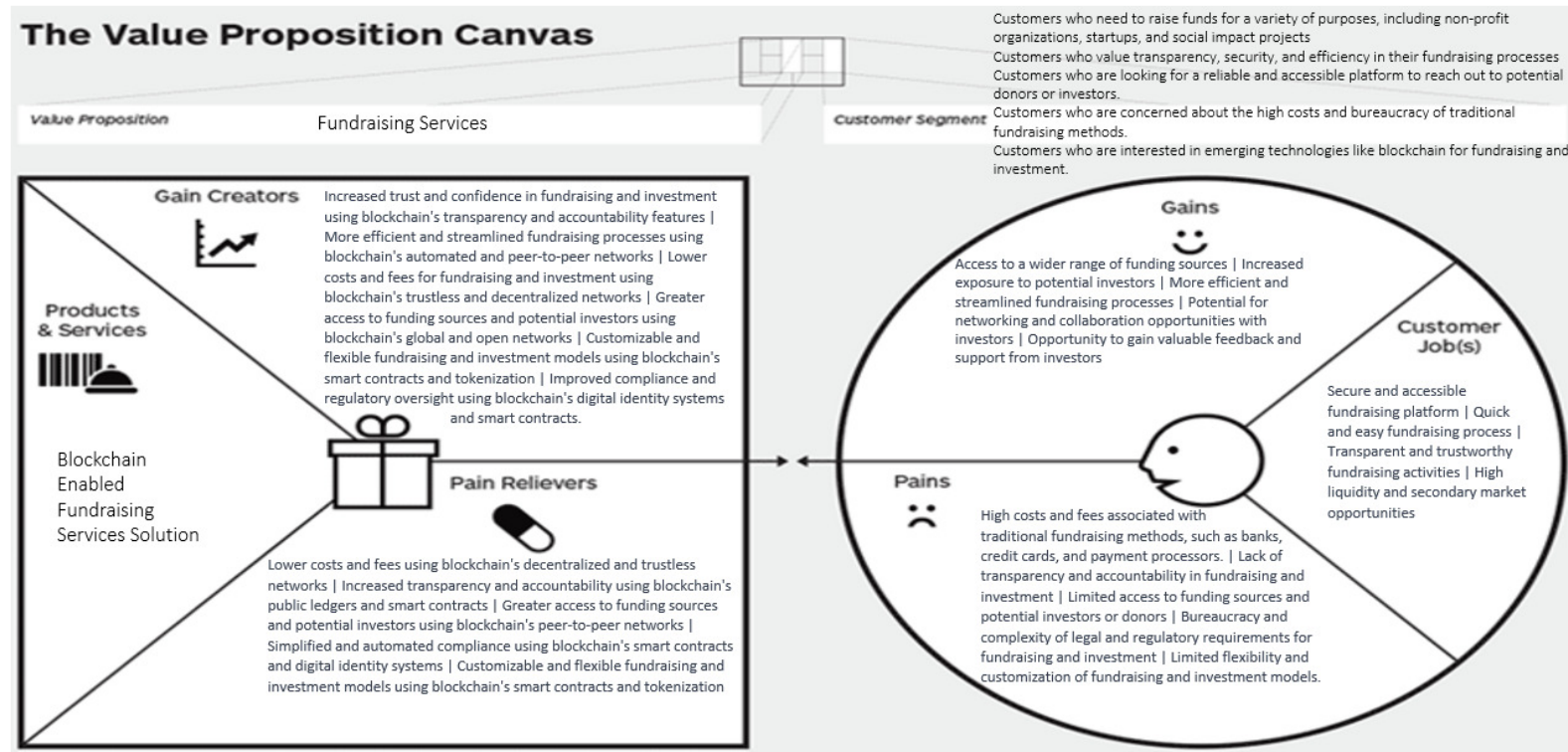


Figure 17. Fundraising value proposition canvas

Value Proposition: This Blockchain-based business fundraising platform offers startups and small businesses a secure and accessible platform for quick and easy fundraising. By leveraging Blockchain technology, we provide increased transparency and trust in fundraising activities and the use of funds. Our automated and streamlined fundraising processes through smart contracts and automation help reduce costs and make fundraising more efficient. Additionally, we provide increased liquidity and secondary market opportunities through the tokenization of assets.

V. Securities

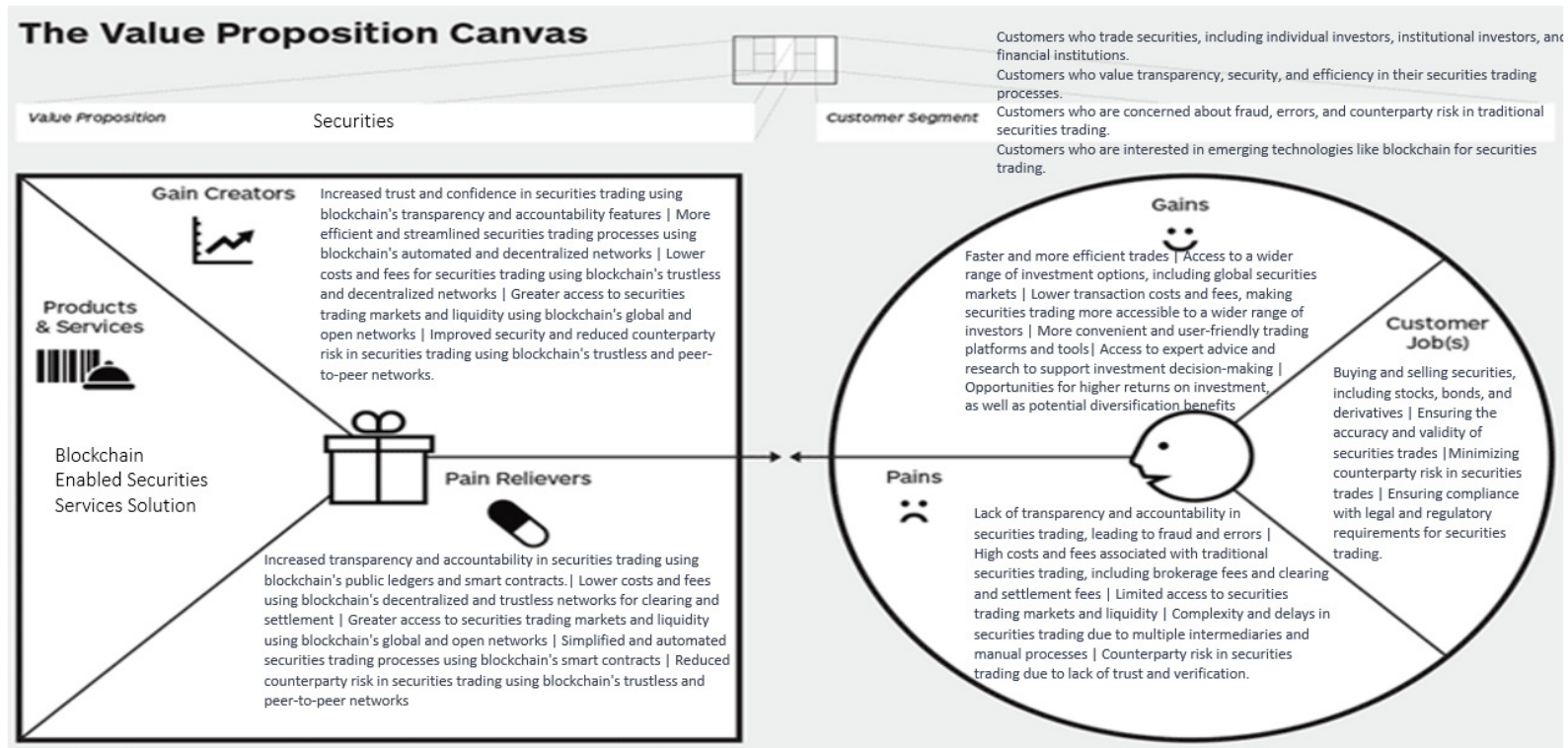


Figure 18. Securities value proposition canvas

Value Proposition: This Blockchain-powered banking service transforms the securities industry by offering efficient and transparent trading solutions. Leveraging the immutability and decentralized nature of Blockchain, it reduces intermediaries and enhances security. With streamlined processes, lower costs, and increased accessibility to a wider range of securities, the solution empowers investors to seize opportunities and trade with confidence in a trusted and technologically advanced ecosystem.

VI. Clearing and Settlement

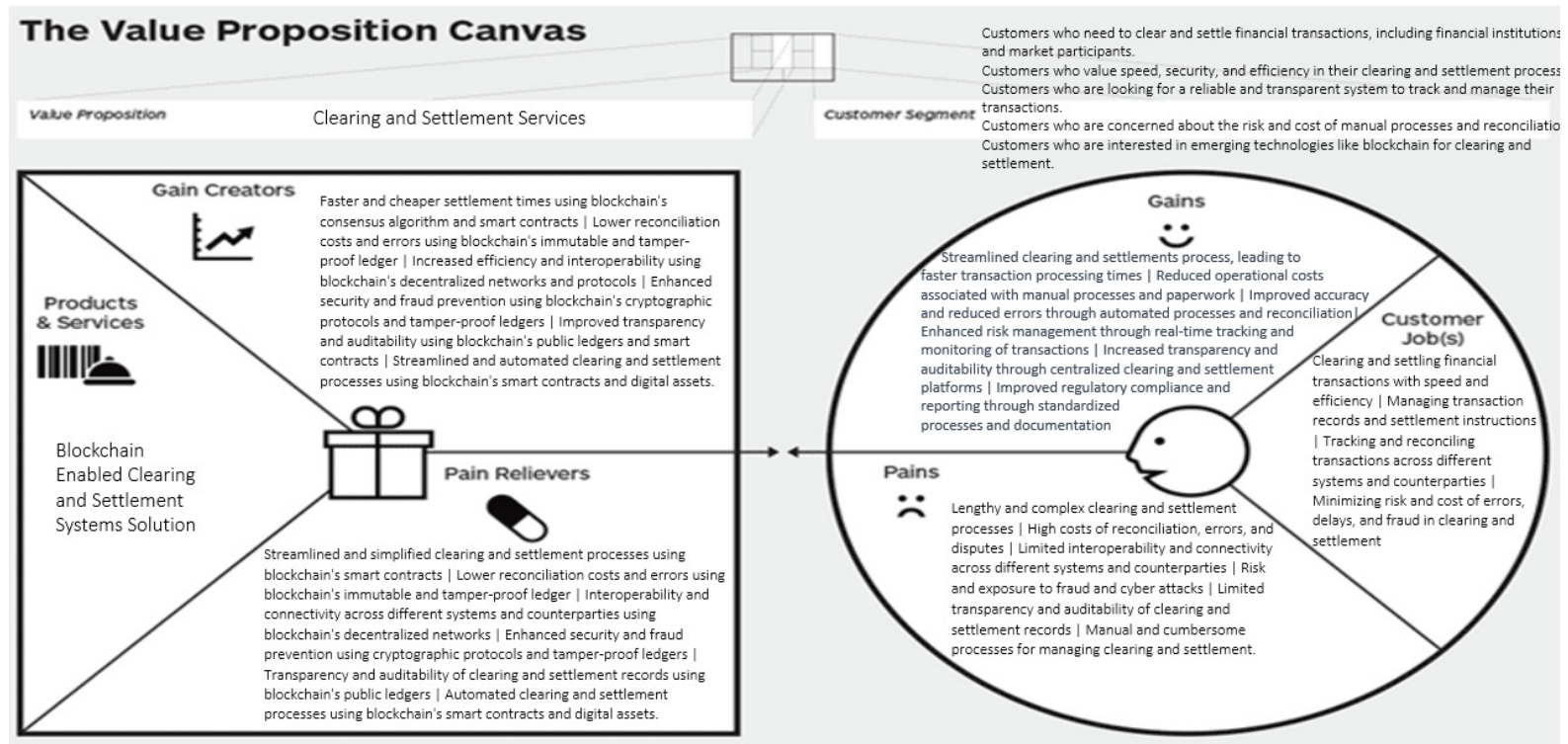


Figure 19. Clearing and Settlement value proposition canvas

Value Proposition: for banks, financial institutions, payment processors, and businesses engaged in financial transactions, our clearing and settlements banking services using Blockchain technology offer a faster, more efficient, and cost-effective solution for clearing and settlements. By leveraging Blockchain-based tracking and verification, we provide increased transparency in the process, reduce counterparty risk and default risk, and improve compliance and regulatory compliance through immutable Blockchain records.

VII. Trade Finance

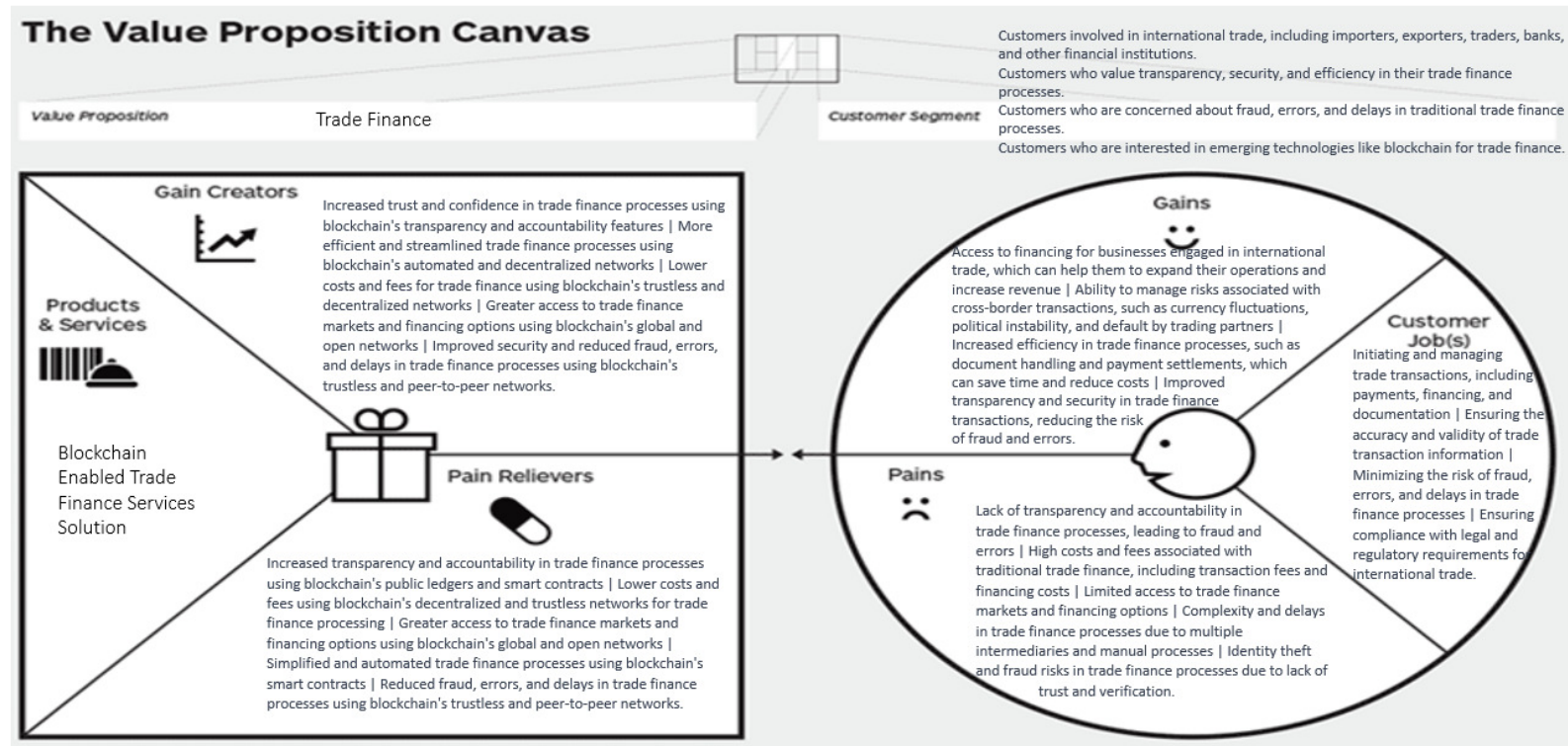


Figure 20. Trade finance value proposition canvas

Value Proposition: this banking service revolutionizes trade finance by providing secure and streamlined solutions. Leveraging the transparency and efficiency of Blockchain, it enables seamless documentation management, faster approvals, and reduced risk of fraud. With smart contract automation and real-time visibility into trade transactions, it empowers businesses to optimize working capital, mitigate risks, and accelerate global trade. The solution transforms trade finance into a seamless and reliable process, facilitating growth and unlocking new opportunities for businesses worldwide.

7.3. Prioritization of Use Cases

Stakeholders of Type 3 and Type 4, represented by experts with more knowledge in the product/service solutions for adopting Blockchain in banking use cases of their traditional banking or investment banking, provided a clear view of their opinion on what should be the prioritization of use cases for the adoption of Blockchain.

Traditional Banking

In traditional banking use cases, experts agreed that Loans and Credit is the segment where more value-added can be obtained, through the usage defi and smart contracts, reducing the administrative burden, making approvals faster and allowing for financing to reach a bigger audience.

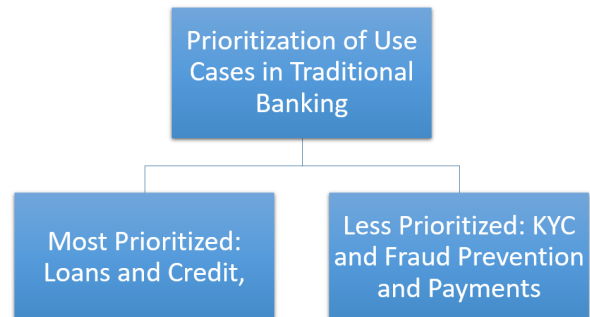


Figure 21. Thematic analysis: Prioritization of use cases in traditional banking

Experts C, E, and F agree that payments have evolved much in the last few years, with instant and mobile payments, and therefore Blockchain might have a limited value there. Although experts C and E agree that international payments might still benefit from adoption, delays, and high costs still burden customers.

KYC and Fraud Prevention divide the opinions as Expert D does not believe to be value added for this use case and experts E and F agree that the costly legacy banking processes that manage these validations can be significantly improved with Blockchain.

Table 5. Experts' opinions on the prioritization of uses cases of traditional banking

| Expert | KYC and Fraud Prevention | Loans and Credit | Payments |
|----------|--------------------------|------------------|----------|
| Expert C | 2 | 1 | 3 |
| Expert D | 3 | 1 | 2 |
| Expert E | 1 | 2 | 3 |
| Expert F | 1 | 2 | 3 |

Investment Banking

Experts agree that trade finance is a priority use case to adopt Blockchain. This goes in sync with the literature review as it is one of the most cited use cases, due to its manual and paper legacy procedures, burdening validation processes, and costly fees. The gains from automation with smart contracts and real-time visibility into trade transactions empower businesses to optimize working capital, mitigate risks, and accelerate global trade.

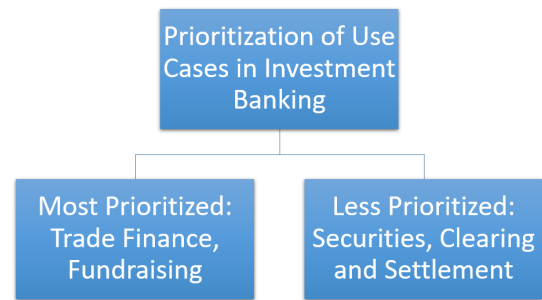


Figure 22. Thematic analysis: prioritization of use cases in investment banking

The next most cited use case, in particular by experts D and E, is Fundraising. Tokenization of assets can not only reduce costs but significantly enlarge the market of assets available to finance and trade, from already digitized assets, such as stocks or bonds, as mentioned by Expert C, but also for real assets such as real estate, as mentioned by Expert E.

Securities trading and clearing and settlement are the least prioritized used cases for Blockchain adoption by experts. But it is logical that if tokenization of assets starts to be implemented, probably these two use cases will gain more importance, as complete and seamless integrated process, from fundraising to trading, to confirmation and settlement.

Experts C and E mention the securities use case in the sense of a new asset category that is emerging: cryptocurrencies or more broadly defined crypto assets. They mention a regulatory environment that is clearer for banks to operate creating conditions for them to start providing that service. In the case of clearing and settlement, Expert E mentions some examples, and tests, which are being made by clearing houses and counterparties, although full adoption is still far away.

Table 6. Experts' opinions on the prioritization of investment banking use cases

| Expert | Fundraising | Securities | Clearing and Settlement | Trade Finance |
|----------|-------------|------------|-------------------------|---------------|
| Expert C | 3 | 1 | 4 | 2 |
| Expert D | 1 | 4 | 3 | 2 |
| Expert E | 1 | 4 | 3 | 2 |
| Expert F | 4 | 3 | 1 | 2 |

7.4. Factors Leading to Blockchain Adoption

Experts also evaluated, according to their opinion, the most relevant factors that can lead to Blockchain adoption. The technology-product-market model was an inspiration for this analysis, as it is a model that emphasizes the interplay between technology capabilities, product offerings, and market dynamics to create value and achieve competitive advantage (Chesbrough, H., 2003 and Teece, D. J., 2010). According to the technology-product-market model, to make a successful product or service to market fit, several important criteria should be taken into account. These criteria help align the technology, product, and market aspects to create a viable and suitable business model. For this research it was defined the following key criteria to consider:

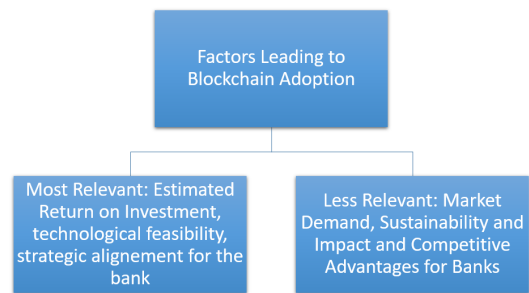


Figure 23. Thematic analysis: factors leading to Blockchain adoption

1. **Market Demand:** Assessing market demand is crucial to identify areas where innovation can create value and meet unmet needs. This can involve analyzing customer preferences, market trends, and emerging opportunities.
2. **Competitive Advantage:** Evaluating the organization's core competencies, resources, and capabilities can help identify areas where it has a competitive advantage. Innovating in areas that leverage existing strengths increase the likelihood of success.
3. **Technological Feasibility:** Considering the organization's technological capabilities and assessing the feasibility of implementing innovative solutions is important. It includes evaluating the availability of technology, infrastructure, and expertise.
4. **Strategic Alignment:** Aligning innovation efforts with the organization's strategic goals and long-term vision is crucial. The selected area should be in line with the organization's mission, values, and strategic priorities.
5. **Return on Investment:** Analyzing the potential return on investment and financial viability of innovation efforts is essential. This involves considering factors such as revenue potential, cost savings, profitability, and suitable business model.
6. **Sustainability and Impact:** Assessing the environmental, social, and ethical implications of innovation is becoming increasingly important and can be a criterion for selection.

Using the criteria defined by the technology-product-market model, each expert weighted each factor from 1 - the lowest weight to 5 - the most weight:

Table 7. Experts' opinions on the most relevant factors for Blockchain adoption

| | Market Demand | Competitive Advantage of Banks | Technological Feasibility | Strategic Alignment for Bank | Estimated Return on Investment | Sustainability and Impact |
|----------|---------------|--------------------------------|---------------------------|------------------------------|--------------------------------|---------------------------|
| Expert A | 1 | 1 | 3 | 2 | 4 | 5 |
| Expert B | 2 | 3 | 4 | 4 | 5 | 1 |
| Expert C | 5 | 3 | 5 | 4 | 5 | 3 |
| Expert D | 3 | 2 | 3 | 4 | 5 | 1 |
| Expert E | 3 | 3 | 4 | 5 | 4 | 3 |
| Expert F | 5 | 4 | 5 | 5 | 4 | 3 |
| Total | 19 | 16 | 24 | 24 | 27 | 16 |

Estimated Return on Investment

“Estimated Return on Investment” is the most cited factor by the experts to lead to Blockchain adoption. For a use case to be viable to a bank, it needs to provide a view that it can produce a value-added return, as experts D and F have mentioned, by cutting costs, simplifying the operational structure, or providing revenue expansion. For Expert F it is important to ensure the benefits outweigh the implementation costs, otherwise, the motivation for the adoption projects is diminished.

Table 8. Experts' views on profitability impacts of Blockchain adoption

| Use Case | Revenues | Costs | Profitability |
|------------------------|-----------------------------------------------------------------------------------------------------------|------------------------------------------------------------|---------------|
| KYC & Fraud Prevention | Same, as revenue is small or nonexistent for this use case | Lower administrative costs, improved speed | Higher |
| Loans and Credit | Higher, with increasing addressable market | Lower, with automation of loans lifecycle | Higher |
| Payments | Lower, as fees can decrease significantly (in particular international payments) and competition increase | Lower, as Blockchain can remove unnecessary intermediaries | Lower |

| Use Case | Revenues | Costs | Profitability |
|-------------------------|------------------------------------------------------------------------------|---------------------------------------------------------------|---------------|
| Fundraising | Higher, with increasing addressable market | Lower, with increased capacity and less administrative burden | Higher |
| Securities | Lower, as competition increases and the role of intermediaries is challenged | Lower, as direct access with no intermediaries is possible | Lower |
| Clearing and Settlement | Same, as revenue is small or nonexistent for this use case | Lower administrative costs, improved speed | Higher |
| Trade Finance | Higher, with increasing addressable market | Lower administrative costs, improved speed | Higher |

Technological Feasibility

The next two most cited factors are “Technological Feasibility” and “Strategic Alignment”.

Regarding “Technological Feasibility” it is one of the most mentioned challenges in the literature review in terms of scalability concerns, the lack of interoperability and common standards across different Blockchain platforms, and security and privacy concerns. Expert D discusses the advancements that are being made in the technology expressing his confidence that Blockchain addresses the mentioned technical limitations and expressing its maturity and stability to be used. Expert E, confirmed also the evolution of the technology in terms for example of preserving confidentiality, with shading and layering features, but along with other experts they mentioned that one alternative to deal with these limitations is the creation of private Blockchains, composed of groups or consortiums of Banks, who created conditions for the implementation and share the network in a more secure and operational environment.

Another aspect of the “Technological Feasibility” discussion was raised by Expert F, who mentions that, on the other side, each bank needs to assess the adoption having into account the organization's technological capabilities, infrastructure, and expertise. It might not be within the reach of any institution.

Strategic Alignment for the Bank

“Strategic Alignment for the Bank” is also mentioned highly as an important factor. To adopt Blockchain a bank needs to be strategically aligned with what the adoption will bring. They need to define the use cases that can make sense to improve by adopting Blockchain. They need to have the necessary conditions for adoption, as discussed in “Technological Feasibility”. They need to have a vision of how the activity can develop and how the whole bank can adapt to it. Expert F mentions that alignment is crucial, as it needs to be in line with the organization's mission, values, and strategic priorities.

The least mentioned factors are “Market Demand”, “Sustainability and Impact” and “Competitive Advantage of Banks”.

Market Demand

“Market Demand” is mentioned by experts C and F as a relevant factor to take into account but not so much by the other experts. Blockchain is a disruptive technology and it might not still be understood by customers how it can improve their experience. Customers demand more speed, more transparency, and lower costs. But they don't know and don't need to know if Blockchain can deliver that for them. That decision will have to come from Banks.

Expert F shared that the focus on the customer need, the client centricity is *“crucial to identify areas where innovation can create value and meet unmet needs”*.

Sustainability and Impact

Although a growing factor nowadays in investment decisions especially for impact investors, “Sustainability and Impact” was not highlighted as one of the most important factors for Blockchain adoption. Expert F emphasized that banks need to consider the broader implications of Blockchain adoption, not just only financial and business strategy, *“but the positive impacts on customers, society, and the environment”*.

Competitive Advantage of Banks

Building a competitive advantage is not seen as a primary factor for the adoption of Blockchain by experts. It still demonstrates some resilience in treating Blockchain adoption as an opportunity, a priority, and a way to get ahead of competitors.

Expert E, discussed this saying that banks had an initial reaction concerning Blockchain which was a defensive one, and treated it as a threat. It is a hard decision to make, they need to build a new infrastructure from scratch and keep the older one, to try to somewhat disrupt themselves. But as regulation is becoming clearer and technology evolves, a consensus is growing that they need to do this. Otherwise, they can fall into the innovator's dilemma trap (Christensen, C. M., 2013), where companies try to keep their old profitable business, only to see it finally get disrupted by a new product or service powered by new technology.

Expert E mentions that *“you cannot stop innovation”*. So, sooner or later it will catch the market.

7.5. Business Model and Market Structure Dynamics

Business Model Dynamics

When thinking about how business models can change from their current state, described in 4.3 Use Cases Business Models, and following the adoption of Blockchain, experts cannot provide a full picture, as a lot is simply unknown. But estimated trends can be pointed out.

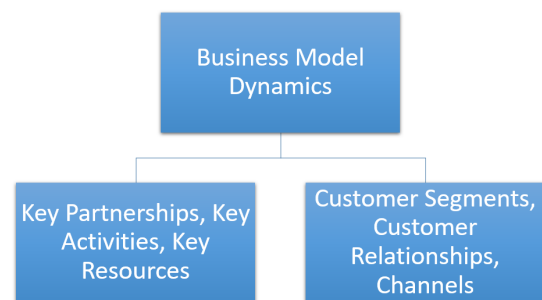


Figure 24. Thematic analysis: business model dynamics

As we have seen in 7.2. Blockchain Value Propositions, in general, value propositions are going to be impacted by the most relevant benefits brought by Blockchain: transparency, speed, and lower costs. But will also be impacted by the challenges of scalability, interoperability, and security.

Customer segments can expand to include individuals and businesses interested in utilizing Blockchain-based services. This is more probable to occur in Loans and Credit, as processes are simplified and capacity and availability are built, and in Fundraising use cases, as more assets can be tokenized, as emphasized by experts C, D, and E.

Customer relationships may also evolve as Blockchain technology allows for more direct transactions. The bank can provide advisory services, education, and support related to Blockchain adoption. Additionally, it can offer user-friendly interfaces and experiences for customers interacting with Blockchain-based systems. Expert A mentions that personal relationships will not be lost despite technological evolution. Expert D discussed that to

many customers having a place where they can custody their assets, or request a service will still be a first choice.

New digital channels will be introduced to facilitate Blockchain-based services. This can include mobile and web applications for cryptocurrency wallets, Blockchain asset management platforms, or decentralized finance (DeFi) platforms. Existing channels may be updated to incorporate Blockchain capabilities. Expert C discussed the advancement for example in Cryptocurrencies trading platforms relative to other types of assets, signaling that experiences can be improved significantly.

New key partnerships can be formed. It was discussed by experts C, D, and E the possible need to form private Blockchain networks, to address some of the Blockchain challenges. Regulatory considerations will also demand a close partnership with regulators, as mentioned by Expert E, as new regulatory frameworks specific to cryptocurrencies, digital assets, and Blockchain technology will be put in place. Other partnerships that will also be needed are with Blockchain technology providers, Blockchain market exchanges, or clearing houses.

The bank's key resources may need to include, as mentioned by Expert F, Blockchain technology infrastructure, skilled personnel, partnerships with technology providers, and strong cybersecurity measures to protect Blockchain-based assets and data.

The key activities of banks will need to include the development of Blockchain-based solutions, such as decentralized ledgers for transaction processing, smart contracts for automated agreements, and identity verification systems. The bank may also engage in Blockchain research, innovation, and collaboration to stay at the forefront of this technology.

About revenue streams and cost structure, a possible evolution was discussed in detail in 7.4. Factors Leading to Blockchain Adoption around the topic of “Estimated Return on Investment” impacts from Blockchain adoption per use case.

Market Structure Dynamics

When thinking about the impacts of Blockchain adoption on different banking use cases, one needs also to take into account the possible changes in the market structure itself.

Over the long-term, all Blockchain banking use cases have the potential to disrupt Banks'

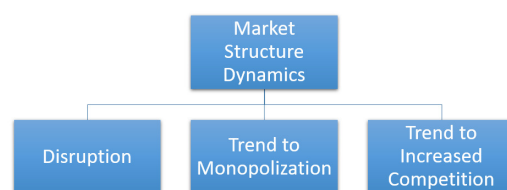


Figure 25. Thematic analysis: market structure dynamics

activities altogether, as discussed by Expert D. If trust in transactions is established by the technology why would any intermediaries be necessary to the process? In practical terms, a lot of issues can be derived from this discussion, as it would mean the complete deregulation of banking activities. Anyone could provide financing or make a trade directly with a peer. But risk assessment quality would certainly decrease. We need to take into account that a lot of the regulations that banks have to comply with are related to the concerns that governments and central banks have concerning the solvability of banks and the banking system. Banks need to demonstrate that they are loaning to people who can pay it back and that they have enough capital to support possible losses. Investment banks need to demonstrate that they are transparent with the trades they are doing with clients and that they also have sufficient capital to handle trade book losses.

Therefore, it is very difficult to imagine an environment where banks are no longer needed. Some use cases can certainly be disrupted by Blockchain and reduce some of their revenues, as discussed in 7.4. Factors Leading to Blockchain Adoption, but the part of banks in the financial system will remain, as defended by Expert E.

When thinking about the possible impacts on the market structures of the specific use cases, Expert D shared that he thought significant changes can be witnessed. In the short to middle term, he believes that the banking system and its market structure are stable given the heavy regulatory environment and the closeness between banks and central banks themselves. Expert E agreed with this view.

But over the long term, with the affirmation of Blockchain in the market, and the increased confidence and build trust in the technology, Expert D suggests that progressive deregulation can be achieved. These factors, and the different dynamics of each use case, can lead to different market structures (Jeffrey, M., 2008) and trends over time.

For Payments, Expert D believes that with its simplification and removal of intermediaries, very few players will be needed to provide the infrastructure of Payments. Therefore, over the long term, much like other big tech businesses, Expert D believes the business can turn into a winner-takes-all structure or close to a monopoly.

The same logic can be applied to Securities Trading together with Clearing and Settlement. If no intermediaries are needed, exchanges can just take orders directly from investors, execute trades, and clearing and settlement can be done integrated and at the same moment. So, over time, these can also become highly concentrated businesses in a few players.

On the other way, a use case such as Loans and Credit can become highly competitive. In this case, Expert E believes that as Blockchain brings trust to transactions, banks will no longer compete by their trustful brand, but only by price. If we also witness deregulation, the doors we open to a significant increase in the number of players in the industry. As said before the addressable market should also grow as the simplification and efficiency of the process allows for more people to get access to this service.

Fundraising can have a similar dynamic, with the growth of the regulated exchanges themselves but also of crowdfunding-like platforms and over-the-counter (OTC) businesses. An increasing amount of assets, from different asset classes, can now start to get access to these funding sources. It can lead to an increase in the competition dynamic. Trade Finance can also verify a similar trend. The difference between Fundraising & Trade Finance and the Loans and Credit business is the volume of trades. Higher volume on Fundraising & Trade Finance makes it more protected from competition than Loans and Credit.

KYC and Fraud prevention will also simplify processes for Banks, contributing to the trend of increased competition.

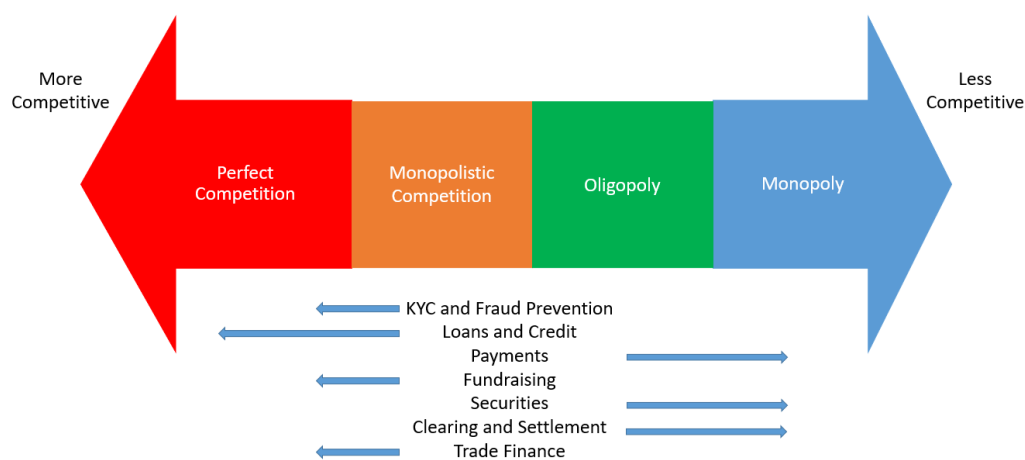


Figure 26. Experts’ views on the market structure impacts of Blockchain adoption

7.6. European Regulation Developments

Another theme discussed was the recent developments happening in European regulation, that experts C, D, and E believe can be beneficial for the Blockchain ecosystem.

In particular, MICA (Markets in Crypto-Assets) and DLT (Distributed Ledger Technology) Pilot are two notable initiatives related to Blockchain regulation and adoption in the European Union (EU) that were mentioned.

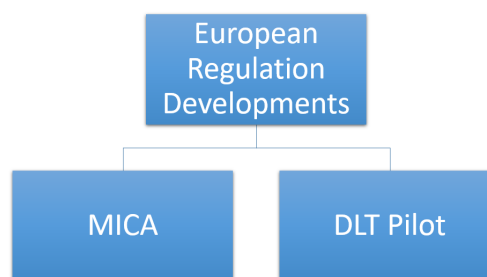


Figure 27. Thematic analysis: European regulation developments

MICA is a proposed regulatory framework developed by the European Commission to establish rules and regulations for crypto-assets, including cryptocurrencies and stablecoins, within the EU. The aim is to create a harmonized regulatory framework that provides legal clarity, and consumer protection, and promotes market integrity. MICA is intended to address various aspects such as licensing, governance, investor protection, and operational requirements for entities involved in crypto-assets.

The MICA proposal was announced in September 2020 as part of the EU's broader digital finance package. It is still in the legislative process, and its final form and implementation are subject to approval by the European Parliament and Council.

Regarding the DLT Pilot, the European Central Bank (ECB) has been exploring the potential of DLT in the financial sector through its DLT Pilot project. The project aims to investigate the benefits, challenges, and use cases of DLT in the market infrastructure for securities settlement.

The DLT Pilot focuses on the issuance, trading, and settlement of securities using DLT technology. It involves testing and experimentation with the integration of DLT into existing market infrastructure systems. The ECB collaborates with various stakeholders, including banks, technology providers, and market infrastructure providers, to assess the viability and scalability of DLT in a regulated environment.

The DLT Pilot is part of the broader efforts to understand the implications of Blockchain and DLT for the financial industry, including their potential impact on efficiency, security, and financial stability.

Experts C, D, and E demonstrated their support of these initiatives as a good starting point, although Expert C mentioned his suspicions of the outcomes of this, and Expert E mentioned the limited volumes dedicated to the pilot.

8. Conclusions

Blockchain is the underlying technology that enables the existence and functioning of cryptocurrencies, but that has significantly broader applications beyond just digital currencies. It can be used in different industries including the Banking industry.

The objective of this dissertation is to understand how can different banking services make the best use of Blockchain technology.

To achieve the purpose of the dissertation, a literature review was made, a detailed description of the different banking use cases and business models, and a thematic analysis was performed to gather valuable insights from a list of banking and Blockchain experts.

The findings of this research shed light on various aspects related to the adoption of Blockchain technology in the banking industry. Several key themes have emerged, highlighting the challenges faced by banking customers, the prioritization of use cases for Blockchain adoption, factors that can lead to Blockchain adoption, and business model and market structure dynamics.

The challenges faced by banking customers include delays in banking processes, bureaucratic procedures, excessive fees, and the importance of trust in the relationship between banks and customers. These insights emphasize the growing demand for automation, immediate responses, and user-friendly banking solutions to enhance the overall customer experience.

The findings of the research also allowed for value propositions to be built for each banking use case, which was validated by experts' insights.

When it comes to the prioritization of use cases, experts with knowledge of traditional and investment banking agree that loans and credit is the most valuable use case in the traditional banking sector. The adoption of Blockchain technology in this area can streamline processes, reduce costs, and expand financing opportunities. Payments is seen as the least valuable use case. In the investment banking sector, trade finance and fundraising are identified as the priority use cases due to their potential for automation, risk mitigation, and optimization of global trade. Securities trading is seen as the least valuable use case.

The factors that can lead to Blockchain adoption were examined through the lens of the technology-product-market model. The experts' opinions indicate that estimated return on investment, technological feasibility, and strategic alignment with the bank's goals and long-term vision should be the most significant factors driving adoption. On the other hand,

market demand and the competitive advantage of banks are less frequently cited as primary factors.

The analysis of business model and market structure dynamics suggests potential changes that may occur with the adoption of Blockchain technology. Customer segments may expand, customer relationships may evolve towards more direct transactions and new digital channels and partnerships may be formed. Banks will need to allocate key resources, engage in specific activities, and prioritize cybersecurity measures to protect Blockchain-based assets and data.

Overall, this research provides valuable insights into the adoption of Blockchain technology in the banking industry. The findings highlight the challenges, opportunities, and priorities associated with this disruptive technology. As Blockchain continues to evolve and regulatory frameworks become clearer, banks will need to carefully assess the potential benefits and risks of adoption, align their strategies, and leverage the technological capabilities to enhance customer experiences, streamline processes, and drive innovation. By doing so, banks can position themselves at the forefront of the industry and navigate the evolving landscape of digital finance successfully.

9. Limitations and Future Research

For the conclusion of this dissertation, the major limitation was the time constraint. The purpose of studying several banking use cases and making the distinction between them was very important and produced valuable insights, but was very time-consuming.

Regarding future research opportunities, the understanding of the factors that influence the adoption of Blockchain technology by banks looks to be crucial for guiding effective implementation strategies. Future research can focus on investigating the strategies employed by early adopters and examining their impact on organizational performance and competitive advantage. This could involve analyzing case studies, conducting surveys, and interviews to identify best practices, key success factors, and lessons learned from real-world Blockchain implementations in the banking industry.

Another area for future research is to explore the long-term impacts of Blockchain adoption in the banking industry. This could involve conducting studies to track the changes in customer behavior, market dynamics, and competitive landscape over an extended period. By examining the effects of Blockchain implementation on key performance indicators such as customer satisfaction, operational efficiency, and profitability, researchers can gain insights into the sustained benefits and challenges associated with this technology.

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Annex

1. Glossary

Blockchain: A decentralized, digital ledger of transactions that is managed by a network of computers on the internet.

Cryptocurrency: A digital or virtual currency that uses cryptography for security.

Bitcoin: The first decentralized cryptocurrency that was created in 2009.

Ethereum: A Blockchain platform that allows for the creation of smart contracts and decentralized applications.

Mining: The process of using computer power to verify transactions and add them to the Blockchain.

Hash: A mathematical function that takes an input of any size and produces a fixed-size output.

Wallet: A digital storage space for cryptocurrency.

Node: A computer or device that participates in the network and helps to validate and record transactions.

Distributed ledger: A ledger that is spread across a network of computers, rather than being stored in a central location.

Smart contract: A computer program that automatically executes the terms of a contract when certain conditions are met.

Public key: A unique code that allows for the encryption and decryption of data on the Blockchain.

Private key: A secret code that grants access to the corresponding public key.

Consensus algorithm: A mechanism for ensuring that all participants in a Blockchain network agree on the state of the ledger.

Proof of Work (PoW): A consensus algorithm that requires users to solve complex mathematical problems to add new blocks to the Blockchain.

Proof of Stake (PoS): A consensus algorithm that allows users to validate transactions based on the amount of cryptocurrency they hold.

2. Interviews Scripts

A - Script for semi-open interviews of traditional banking experts:

- 1 - What are the biggest challenges that banks face in offering their services to their customers?
- 2 - How do these challenges affect the customer experience when using a banking service?
- 3 - In your opinion, what are the most common complaints or pain points that customers have?
- 4 - Have you noticed any changes in customer behavior or preferences?
- 5 - What steps have banks taken to address these challenges and improve the customer experience of banking services?
- 6 - How successful have these measures been in addressing the pain points that customers face?
- 7 - How do you see the future of banking services evolving in the next 5-10 years?

B - Script for semi-open interviews of investment banking experts:

- 1 - Introduction: Introduce yourself, explain the purpose of the interview, and provide some context about the thesis. Explain that the goal of the interview is to understand which banking use cases are more likely to be disrupted by Blockchain and why, and what the consequences will be for banking business models. Present the banking use cases that are being studied.

Traditional Banking

- I. Customer KYC and Fraud Prevention
- II. Loans and Credit
- III. Payments

Investment Banking

- IV. Fundraising
- V. Securities Trading
- VI. Clearing and Settlement
- VII. Trade Finance

2 - Background questions: Ask the interviewee about their background and experience in the banking industry. Try to understand their understanding of Blockchain technology, its potential, and limitations.

3 - Current banking use cases: Ask the interviewee about the current banking use cases that they are familiar with. Ask them to provide some details about these use cases, including the type of service provided, the current state of the service, and the benefits and limitations of the current system.

4 - Potential for Blockchain: Ask the interviewee about the potential for Blockchain to improve these use cases. Ask them which use cases are more likely to be disrupted by Blockchain and why. Ask them to explain the benefits and limitations of using Blockchain in these use cases.

5 - Consequences for banking business models: Ask the interviewee about the potential consequences for banking business models if Blockchain disrupts these use cases. Ask them how this disruption might change the way banks operate, including changes to revenue models, cost structures, and customer relationships.

6 - Barriers to Blockchain adoption: Ask the interviewee about any potential barriers to Blockchain adoption in the banking industry. These could include regulatory challenges, technical limitations, or resistance from industry stakeholders.

7 - Emerging use cases: Ask the interviewee about any emerging use cases for Blockchain in the banking industry. What new services or applications could Blockchain enable, and how could these disrupt traditional banking business models?

8 - Risks and challenges: Ask the interviewee to identify any potential risks or challenges associated with Blockchain adoption in the banking industry. These could include security risks, regulatory challenges, or unexpected consequences resulting from changes to business processes.

9 - Conclusion: Thank the interviewee for their time and insights. Offer them the opportunity to ask any questions or provide any additional comments they may have. Lastly, ensure the interviewee is aware of the procedures for anonymizing the data collected during the interview.