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Master's degree in Innovation and
Industrial Management

The Internet of Banking: how blockchain can revolutionize the banking system.

An exploratory case study in the Italian banking industry:
the Spunta Banca DLT project.

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The Internet of Banking: how blockchain can revolutionize the banking system

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ABSTRACT

The driver of this study is the growing interest in blockchain technology and its use to develop inter-organisational structures considered capable of ensuring important benefits such as system transparency, operational simplification, efficiency improvement, counterparty risk reduction and so on. Even though there is great enthusiasm for this topic, there are few projects that have been able to reach an operational phase by going beyond the experimental stage since the failure rate is very high. This research contributes to the current debate by empirically exploring the factors that determine success in the development of platform ecosystems using blockchain, and the main benefits and challenges. To achieve this goal, the research provides an in-depth analysis of the Spunta Banca DLT project, a project started in 2017 that implemented an inter-organisational platform based on blockchain technology within the Italian banking sector for the management of the interbank reconciliation process. Qualitative interviews were conducted with project participants to gain important insights into the platform development process and the use of the technology. Based on the findings gathered from the interviews, the main drivers that led to the successful development of the platform and the consequences in terms of the benefits and challenges of adopting the new system were highlighted.

Keywords: blockchain; distributed ledger technology; digital platform; platform ecosystem; banking.

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1. INTRODUCTION

This chapter defines the research field of the paper, discussing the background of the research topic and the problem of interest and introducing the research purpose and the research question. To conclude, the delimitation of the research and the structure of the paper are presented.

1.1 Research background

Nowadays, blockchain has become a buzzword that generates great appeal whenever it is used. The opportunities associated with this technology seem to be countless in a wide variety of fields, even if most of them are still totally unexplored or tested.

Blockchain is a technology that enables the creation and functioning of distributed and decentralized digital databases¹. It uses a mix of cryptography and computer protocols to store and move information following pre-determined sets of rules without the need for intermediaries or human interaction (Ali et al., 2020; Kołodziej, 2019; Spahiu et al., 2021). Data stored are tamper-proof and immutable and it eliminates the need for a central authority that manages the system, allowing transactions between untrustworthy parties in a peer-to-peer manner (Ali et al., 2020; Frankenfield et al., 2021; Malhotra et al., 2021).

Blockchain has the potential to provide unique benefits such as transactional privacy, system transparency, operational simplification, cost efficiencies, counterparty risk reduction, regulatory efficiency improvements, and fraud minimization and many companies are investing heavily in its applications (Catalini & Gans, 2019; McWaters, 2016; Saheb & Mamaghani, 2021).

The banking sector is utmost interested in this technology to improve several of its processes characterised by inefficiencies due to many intermediaries and document exchanges involved such as intra-bank transfers (P2P payments), financial transactions, know-your-customer processes, data protection and ownership (Ali et al., 2020; Stasi & Attanasio, 2021). However, the most fascinating application of blockchain is the creation of a platform-based business

¹ In Appendix A an in-depth look at blockchain technology and the distinction with distributed ledger technology (DLT) is provided.

ecosystem through the development of a digital infrastructure shared and managed by all banks. Such a platform would allow banks to greatly simplify their processes by drastically reducing the time and cost per transaction, as well as improving efficiency and security (Catalini & Gans, 2019; Vella & Gastaldi, 2021).

A main barrier to the creation of a platform within the banking industry has always been the risk of handing over too much power to the intermediary who manages the platform. The use of blockchain technology can help to overcome this barrier as it opens the possibility to create a system that does not need central control but distribute control power equally between all participants (Catalini & Gans, 2019; Pereira et al., 2019).

1.2 Problem discussion

The blockchain has the potential to revolutionize the traditional banking system by increasing efficiency and transparency and resolving the problems of trust, security, and control (Ali et al., 2020; Garg et al., 2021; Harris & Wonglimpiyarat, 2019; McWaters, 2016). It allows the creation of a secure and anonymous ecosystem which does not require third party control, reducing transaction costs and improving coordination among companies (Garg et al., 2021; Saheb & Mamaghani, 2021; Vella & Gastaldi, 2021).

Although blockchain seems to provide great benefits, it presents numerous challenges that need to be tested to assess the actual opportunity of use within a very complex sector such as the banking one. In particular, the main difficulties highlighted in the literature refers to scalability limitation (Ali et al., 2020; Garg et al., 2021; Malhotra et al., 2021), interoperability of the system (Ali et al., 2020; Malhotra et al., 2021; Spahiu et al., 2021), lack of knowledge and understanding (Garg et al., 2021; Saheb & Mamaghani, 2021; Spahiu et al., 2021), lack of regulation (Ali et al., 2020; McWaters, 2016; Saheb & Mamaghani, 2021), lack of infrastructure (Saheb & Mamaghani, 2021; Spahiu et al., 2021), data protection and confidentiality (Ali et al., 2020; Catalini & Gans, 2019; Malhotra et al., 2021).

The idea of using blockchain to build up a platform ecosystem within the banking industry was the foundation of the Spunta Banca DLT project. The Spunta Banca DLT project, promoted by ABI Lab – the innovation division of the Italian Banking Association –, implemented an inter-organisational platform within the Italian banking sector based on blockchain technology for the management of the interbank reconciliation process between Italian banks.

This project aims to test the use of blockchain solution to understand its benefits and limitations and eventually pave the way for an expansion of the platform to other banking operations and to a European level (Stasi & Attanasio, 2021).

1.3 Research purpose and research question

Based on what was presented above, the purpose of this research is to carry out exploratory research on the potential of blockchain in the creation of a platform ecosystem within the banking industry through an inductive approach based on the analysis of the Spunta Banca DLT project in order to derive valuable insights about the creation and the development of the platform, highlighting its requirements, benefits and challenges.

In particular, the research question that this work seeks to address is:

*How has blockchain been used to build a platform ecosystem within the Italian banking industry in the Spunta Banca DLT project?
Which are the main benefits and challenges?*

The aim of this research is to investigate a new field of application of blockchain technology to provide interesting considerations about the possible adoption and development of blockchain-based platforms through a closer look at a cutting-edge project such as the Spunta Banca DLT project.

From an academic point of view, this work can expand the existing literature by providing interesting theoretical considerations on the benefits and challenges of blockchain technology applied to build inter-organisational structures at the industry level.

From a managerial point of view, the contribution of this research concerns the provision of an inspirational example that can serve as a guide on how to develop and implement this technology on an industry level within the banking sector or sectors with similar characteristics, providing the analysis of an innovative use case.

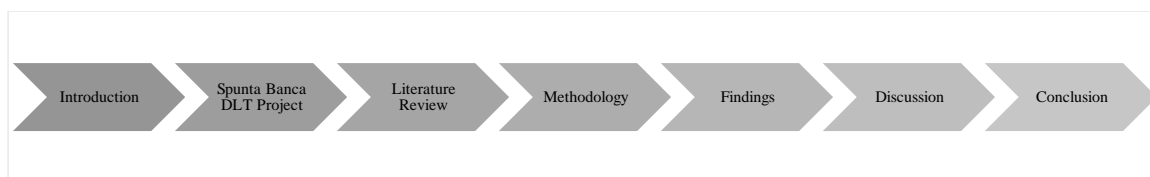
1.4 Delimitation of the research

The delimitation of this study regards mainly three aspects. Firstly, the results of this paper are based only on the analysis of the selected case study, hence the conclusions derived cannot be considered best practices applicable in different contexts but should be understood more as a potential starting point for future research. The second delimitation concerns the specific geographical and regulatory context in which the use case is developed. In fact, since the banking sector is a highly regulated sector with great differences from one country to another, this study and its conclusions are mainly useful for contexts that present similar regulatory and cultural conditions. Lastly, the third delimitation refers to the fact that the research focuses on the development of the platform and the use of the technology from an organisational point of view, without addressing the issue of the technological functioning of the platform.

1.5 Disposition of the research

As shown in Figure 1 below, the paper is divided into 7 chapters.

Figure 1 - Disposition of the research



Note: Elaborated by the author

“Introduction” defined the research field and presented the research purpose and the research question; “Spunta Banca DLT Project” provides a description of the selected case study and its main features; “Literature review” presents the relevant literature for the purpose of the research; “Methodology” explains the methodology applied and the rationale behind each decision; “Findings” highlights the findings emerged from the analysis of the interviews; “Discussion” provides an answer to the research question combining findings and relevant literature; “Conclusion” concludes the research discussing practical and theoretical implications and recommendations for future research.

2. SPUNTA BANCA DLT PROJECT

In this chapter, the case study is presented, highlighting the rationale behind the project, the phases of development, the governance structure, and the differences from the old system. The goal is to provide a clear understanding of the project and its main features. The information in the chapter comes from the reports on the project.

2.1 The project

The Spunta Banca DLT is a project promoted by the Italian Banking Association (ABI) and developed under the supervision of the ABI Lab – the innovative division of ABI. It was started in May 2017 with the ABI Lab leading exploratory meetings with different possible partners, studying the current situation, and formulating possible hypotheses for improvement. The long-term objective of the project was twofold: to test the use of an innovative technology such as blockchain and to create a shared infrastructure within the Italian banking sector – the so-called *ABILabChain* - that could host different initiatives (ABI Lab, 2020; Stasi & Attanasio, 2021).

The working group for the development of the project was composed of 14 banking groups - representing 78% of the Italian banking sector in terms of employees -, NTT Data as application designer, and SIA (now Nexi) as infrastructure operator. The blockchain platform chosen was the private-permissioned DLT *Corda Enterprise* by R3.

They decided to address as the first use case of the platform the reconciliation operations between banks. The interbank reconciliation process concerns the reconciliation of flows and operations that generate entries on bilateral accounts to clear every mismatch in double-entry bookkeeping. This process was chosen as the first application of the platform for four main reasons: it presents low standardization and slow operating processes, it is relatively simple, it is an internal process that does not impact end customers, and ABI is the entity that manages the regulation in Italy (ABI Lab, 2020; Stasi & Attanasio, 2021). The Spunta Banca DLT project aimed to standardize and automatize the process between different banks, reduce operational risk, increase the transparency and quality of the process, and simplify audit activities (ABI Lab, 2020; European Payments Council, 2021; Stasi & Attanasio, 2021; Vella & Gastaldi, 2021).

2.2 The development

Following the feasibility study, which lasted from May 2017 to September 2017, the Proof of Concept was developed, defining, and designing all the features of the platform, and functional tests were carried out (ABI Lab, 2021).

In July 2018, the pre-production phase began, during which a general simulation was carried out with the loading of 2 months of data onto the platform, and the new inter-bank agreement to regulate the process, the governance model of the system and the integration plan were defined. In October 2019, a performance test was carried out by simulating the use of the platform over 12 months with more than 200 million transactions between 200 banks - representative of the entire Italian banking system (ABI Lab, 2021).

The adoption of the platform for the participating banks was done gradually, splitting the entry of the banks into 3 different waves starting on 1 March 2020. The platform became fully operational in October 2020. By March 2021, the platform had reached 100 nodes - thus 100 participating banks – it had processed 332 million transactions, 98.2 per cent of which were automatically matched (European Payments Council, 2021).

Table 1 below provides a summary of the different stages of development, the actions taken and the goals of each one are provided.

Table 1 - Spunta development phases

Phase	Period	Actions	Objectives
Use Case Investigation	29 May 2017 to 30 September 2017	<ul style="list-style-type: none"> • One-to-one meetings with participating banks • Identification of peculiarities of the AS IS process and differences between banks • Model the TO-BE process • Architectural proposals with identified technologies 	<ul style="list-style-type: none"> • Gather information on the different banks processes • Analyse the AS IS process and how it can be improved • Verify that DLT technology can improve the process • Define the main architectural options
Use Case Design	1 December 2017 to 30 April 2018	<ul style="list-style-type: none"> • Determine stages of work • Determine functional requirements • Decide the choices of architecture and infrastructure to support the PoC • Develop the application and the User Interface 	<ul style="list-style-type: none"> • Define the Proof of Concept in all its organizational components

Proof of Concept Testing	4 May 2018 to 30 June 2018	<ul style="list-style-type: none"> • Iterative monitoring and feedback approach • Two test sessions separated by bug fixing interventions • 82 functional tests 	<ul style="list-style-type: none"> • Identify system bugs and fix them • Collect data on system performance and benefits
Pre-production	July 2018 to November 2019	<ul style="list-style-type: none"> • Performance test with 2 months of data uploaded • Definition of new interbank regulation • Definition of project governance • Work plan up to full transition 	<ul style="list-style-type: none"> • Assess the proper functioning of the platform • Develop a regulation adapted to the new system • Define a distributed governance model to coordinate the project
Production	December 2019 - ongoing	<ul style="list-style-type: none"> • Implementation of the banking sector migration plan • Continuous monitoring of the platform • Continuous improvement 	<ul style="list-style-type: none"> • Implement the new system • Ensure the operativity of the new system • Improve the application through data analysis

Note: Elaborated by the author

2.3 The governance

The designed platform has 6 levels of governance in which the above-mentioned participants operate with different functions (ABI Lab, 2020). In Table 2 below the different roles are presented.

Table 2 - Spunta governance layers

Governance Layer	Function	Actor
Business Network	Community who operates on the platform	Banks
Business Network Governor (BNG)	Entity who builds, coordinate and manage the business network	ABI Lab
Business Network Designer (BND)	It develops blockchain applications and takes care of operational support	NTT Data
Business Network Operator (BNO)	It provides one or more application services and takes care of service desk functions	SIA
DLT Network Provider (DNP)	It provides the shared DLT technical infrastructure	SIA
Platform	It provides the blockchain operating system	R3

Note: Elaborated by the author

The most innovative characteristic of the project regards the governance of the platform, which is decentralized. Indeed, the control of the platform is not in the hands of a single entity but shared among all the participants, who have been able to take part in all the decisions concerning the platform since the beginning of the project. ABI Lab, even though it is the subject that started the project and set up the platform under the role of business network governor, essentially acts as a coordinator between the parties without exclusive decision-making powers (Vella & Gastaldi, 2021).

2.4 The process and the regulation

“Spunta” refers to the process of interbank reconciliation of bilateral accounts that banks hold with each other to clear every mismatch in double-entry bookkeeping. Within the Italian banking sector, this operation was governed by an interbank agreement signed in 1978 and updated with amendments in 1994, so both the process and the rules governing it were well established and outdated (ABI Lab, 2021).

The reconciliation process was carried out monthly, according to bilateral agreements between the different banks, where usually the "Spunta owner" was defined, i.e., the bank in charge of the reconciliation process for a given period. The owner was charged for a certain period and then the roles were reversed. Only the owner had full visibility of the transactions. Each bank had its own system to manage movements and identify suspended transactions, and different bilateral agreements had different rules for recognising suspended transactions. In addition, there was no structured communication process between the banks to investigate suspended transactions, hence the employees of different banks were forced to address them to the counterparty through forms of communication such as emails and phone calls, which were difficult to record and be stored for future review (ABI Lab, 2020, 2021).

The new system adopted has revolutionised the interbank reconciliation process, introducing daily reconciliation, standardising and simplifying the process and defining unique rules shared by the entire system. Each bank that participates in the network has installed its data centre and it represents a node in the system, all nodes being interconnected. The nodes communicate with each other automatically through blockchain protocol according to the rules pre-established and automatically check that the entries on the bilateral accounts match. At the current moment, the application allows more than 98% of transactions to be matched automatically and the process of investigating suspended transactions to be carried out within the application.

Moreover, the new system allows both parties involved to have total visibility of transactions, although the figure of the “Spunta owner” remains (ABI Lab, 2020, 2021).

In Table 3 below, a summary of the comparison between the AS-IS and the TO-BE processes is presented.

Table 3 - Comparison of AS-IS/TO-BE processes

AS-IS	TO-BE
Bilateral agreements between banks (biannual/triannual) to define who is the "Spunta owner", the bank who takes care of the process. Only the owner has visibility of all the movements	While remaining the owner of Spunta, both banks have visibility of the movements within the system
Different reconciliation process from bank to bank	Standardisation, simplification and transparency of the process between banks
Monthly reconciliation	Daily reconciliation
Customised reconciliation rules, different for each bilateral relationship between the banks	Shared reconciliation rules, formalised through the 'smart contracts' of DLT technology
Lack of unique and shared rules for identifying suspended transactions to be reconciled	Unique and shared rules for identifying suspended transactions to be reconciled
Investigation process of unstructured suspended transactions through e-mails and phone calls	Structured internal platform investigation process

Note: Elaborated by the author

As regards the regulation, since the interbank reconciliation is regulated by the same entity promoting the project, the Italian banking association (ABI), the adaptation was quite straightforward. The text of the new agreement was approved by the ABI executive committee on 15 May 2019 and communicated to all banks on 13 June 2019 (ABI Lab, 2020). While, concerning the relationship between the different actors, through numerous working tables involving all the legal departments of the participants in the project, a single contract was drafted and signed defining the roles, responsibilities, and rules within the system.

3. LITERATURE REVIEW

In this chapter, the relevant literature for the purpose of the research is presented. The goal is threefold: to highlight the main themes in the literature, to provide a theoretical background to the analysis of the case and to show the contribution this research can make to the existing literature.

3.1 Blockchain technology

Blockchain is a technology that allows the development and functioning of decentralized and distributed digital databases through the mixed use of cryptography and mathematical algorithms.

“*Decentralized*” means that the blockchain-based system does not require the presence of a central authority who manages and controls the registration of data on the database because the information is registered and stored automatically through the application of computer protocols that ensure the validity following a pre-determined set of rules – called smart contracts – without the need of human interactions (Catalini & Gans, 2019; Harris & Wonglimpiyarat, 2019; Spahiu et al., 2021). The verification process is done by all the participants of the system according to a consensus mechanism, which means that all computers within the network – called nodes - must verify the new information before it is added (Ali et al., 2020; Malhotra et al., 2021; Spahiu et al., 2021).

“*Distributed*” refers to the fact that the database is not stored in a single central location, but it is shared among all the network, each node has its copy of the database. Indeed, when a piece of new information is added, the system records the new block – which is the data structure that contains the information - on all the copies at the different nodes at the same time (Ali et al., 2020; Kołodziej, 2019).

The first use case of the technology was Bitcoin, a decentralized digital currency (cryptocurrency), where the blockchain is used to allow financial transactions between parties without the need for a central authority. However, the scope of application of the technology is wide because it can be used to transfer all types of data and digital assets such as medical records, contracts between parties, flows of goods, the authenticity of objects and many more

(Ali et al., 2020; Inasiti & Lakhani, 2017; Spahiu et al., 2021). Thus, blockchain can potentially have an impact on every industry.

The literature highlights many potential benefits that the blockchain can provide. The main ones are complexity reduction (Ali et al., 2020; Buchinger et al., 2020; Malhotra et al., 2021; Saheb & Mamaghani, 2021), cost savings (Buchinger et al., 2020; Catalini & Gans, 2019; Saheb & Mamaghani, 2021; Seebacher & Schüritz, 2017; Spahiu et al., 2021), better coordination among companies (Malhotra et al., 2021; Saheb & Mamaghani, 2021; Vella & Gastaldi, 2021), higher trust between parties (Ali et al., 2020; Malhotra et al., 2021; Pereira et al., 2019; Spahiu et al., 2021; Vella & Gastaldi, 2021), increased data security and data privacy (Ali et al., 2020; Kołodziej, 2019; McWaters, 2016; Pereira et al., 2019), improved transparency and traceability (Kołodziej, 2019; Saheb & Mamaghani, 2021; Spahiu et al., 2021).

However, there are also several barriers that need to be carefully assessed to ensure that they do not hinder the achievement of the above-mentioned benefits. In particular, the literature draws attention to scalability issues (Malhotra et al., 2021; Spahiu et al., 2021), interoperability risk (Catalini & Gans, 2019; Malhotra et al., 2021), lack of knowledge and understanding of the technology and lack of infrastructure (Saheb & Mamaghani, 2021; Spahiu et al., 2021), lack of public-private coordination (Herian, 2018; Malhotra et al., 2021; Saheb & Mamaghani, 2021), lack of regulations and frameworks (Catalini & Gans, 2019; Herian, 2018; Stasi & Attanasio, 2021), low level of performance (Malhotra et al., 2021; Spahiu et al., 2021), difficult application to offline assets (Catalini & Gans, 2019; Davidson et al., 2018).

To sum up, blockchain technology is considered a possible game-changer - or using a Schumpeterian term, a “creative destruction” - in numerous industries by influencing several processes. In the literature, some authors focus on the improvement in the efficiency of operations that it can guarantee whilst others focus on the reduction of transaction costs. Davidson et al. (2018) provide an overarching view of blockchain technology, defining it as an institutional technology that establishes a new mechanism to coordinate economic activity.

3.2 Digital platforms

In recent years, the competition between companies is moving from competition between firms to competition between networks of firms (Mukhopadhyay & Bouwman, 2019; Tan et al., 2022).

Indeed, inter-organizational structures that connect different companies have acquired a central role in many industries and they are expected to dominate the future of the economy (Adner, 2017; Mukhopadhyay & Bouwman, 2019). Companies are shifting toward a more collaborative approach with their competitors within their value chain in order to improve efficiency, reduce risk and strengthen their competitive position (Adner, 2017; Ritala et al., 2014). This new approach that combines both collaboration and competition is defined in the literature as “coopetition” (Ritala et al., 2014) and the main goal is to enhance the value creation process through the exploitation of supplementary and complementary resources of the companies (Mukhopadhyay & Bouwman, 2019; Ritala et al., 2014).

These new types of relationships between companies rely on the use of digital technologies which have provided innovative connection possibilities. In this context, the concepts of “digital ecosystem” and “digital platform” have become a hot topic in the literature because they represent the inter-organizational structures that enable collaboration between companies (Tan et al., 2022).

Digital ecosystems can be defined as a technology-enabled community of actors – people or organizations – that are interwoven and move toward a common goal through an open, flexible, informal and demand-driven collaboration (Aulkemeier et al., 2019; Jacobides et al., 2018; Mukhopadhyay & Bouwman, 2019; Tan et al., 2022). Adner (2017) highlights three main features of an ecosystem: the alignment between parties – which is the degree of mutual agreements about the common goals and the tasks of each participant -; the multilateral connection – which means that there are several actors linked by critical relationships -; and the value proposition – that represents the ideal value the ecosystem aim to achieve.

Digital platforms represent technology-enabled modular structures that aim to connect different entities through formal contracts and/or mutual dependency (Jacobides et al., 2018; Mukhopadhyay & Bouwman, 2019). Thus, digital platforms can be the structure of a digital

ecosystem, but a digital ecosystem can also include different digital platforms (Tan et al., 2022).

Combining these two concepts, Mukhopadhyay and Bouwman (2019) defines the digital platform ecosystem as a “*meta-organisation (collective of firms and individuals) around a digital multi-sided platform with a shared vision on the prosperity of the platform*” (Mukhopadhyay & Bouwman, 2019, p. 331). According to this definition, to be effective a digital platform ecosystem must present tight integration, alignment between participants, and commitment to long-term common goals (Adner, 2017; Aulkemeier et al., 2019).

There is still no common agreement on how the digital platform ecosystem can be planned and created (Vella & Gastaldi, 2021). The literature highlights two main risks which can prevent the success of a digital platform ecosystem that relates to the level of trust between participants and the cost and the complexity of collaboration such as the capacity of all actors to fulfil their tasks, the level of involvement in pursuing the common goals and the acceptance of the roles within the ecosystem (Adner, 2017; Jacobides et al., 2018; Mukhopadhyay & Bouwman, 2019; Yoffie et al., 2019).

3.3 Centralized vs decentralized governance

A main element of distinction between digital platforms concerns the governance structure - which sets out the roles, responsibilities, and processes in the system (Aulkemeier et al., 2019). In particular, the platforms are distinguished into centralised and decentralised platforms based on the level of centralisation of their governance.

Centralised platforms are characterized by a platform provider - also called platform owner, platform leader, or core firm - which manages and coordinates the system defining the rules, the structure, the goals, and the distribution of value between participants. It has exclusive control over the platform, establishing participants, rules, activities, and desired outcomes. (Adner, 2017; Chen et al., 2021; Pereira et al., 2019). This type of governance is the most common one and the main platform ecosystems such as the FAANG companies (Facebook, Amazon, Apple, Netflix, Google) are prominent examples of it. However, the literature highlights several drawbacks of this structure that can hinder the creation and success of platform ecosystems. First of all, the risk that the platform owner assumes an egoistic behaviour prioritizing its interest to detriment of the interests of other platform participants is a key

barrier, in particular in industries where there is a low level of trust between companies which do not want to give up control power such as the banking one (Aulkemeier et al., 2019; Chen et al., 2021; Vella & Gastaldi, 2021). In addition, other main problematic areas cited by the literature are security and ownership of data (Pereira et al., 2019; Vella & Gastaldi, 2021), agreement on the identity of the leader and the different roles (Adner, 2017; Aulkemeier et al., 2019), the fair distribution of value created (Aulkemeier et al., 2019; Chen et al., 2021).

Decentralised structures of governance overcome these barriers creating a shared infrastructure between participants without assigning market power to a third party (Catalini & Gans, 2019; Vella & Gastaldi, 2021). There is no platform owner which has complete control over the platform, the control power is distributed among participants. Usually, there is still an entity – defined as “*platform orchestrator*” (Vella & Gastaldi, 2021) - that sets up the platform and coordinates the different participants, but it gives up the decisional power to them (Chen et al., 2021; Mukhopadhyay & Bouwman, 2019; Vella & Gastaldi, 2021). The community defines the rules, the roles, the activities, and the distribution of value through democratic systems such as voting or general meetings (Davidson et al., 2016; Pereira et al., 2019). However, also this type of structure has its challenges such as a slow decision-making process (Chen et al., 2021; Pereira et al., 2019), the risk of not reaching an agreement between parties and the need for a high level of involvement and collaboration of participants (Chen et al., 2021; Pereira et al., 2019; Vella & Gastaldi, 2021).

Chen et al. (2021) sustain that a moderate level of decentralization – a semi-decentralized governance structure – allows to balance the benefits and challenges of the two extreme structures of governance, exploiting the full potentialities of the platform. Instead, Spagnoletti et al. (2015) argue that the governance structure depends on the social interaction that the platform wants to support. In particular, three different social interactions are identified - information sharing, collaboration and collective action - and for each of them the characteristics of the governance structure best suited to their support are outlined (see Figure 2 below).

Figure 2 - Comparison of information sharing, collaboration, and collective action

<i>Dimension</i>	<i>Information sharing</i>	<i>Collaboration</i>	<i>Collective action</i>
Level of scope congruence	<ul style="list-style-type: none"> ● medium 	<ul style="list-style-type: none"> ● high 	<ul style="list-style-type: none"> ● high
Type of social relationship	<ul style="list-style-type: none"> ● no reciprocity ● impersonal relationships prevail ● identity is unimportant 	<ul style="list-style-type: none"> ● limited reciprocity ● relationships tend to be impersonal ● identity is unimportant 	<ul style="list-style-type: none"> ● reciprocity ● authority ● shared values and beliefs ● relationships can be personal ● identity is important
Type of admittance	<ul style="list-style-type: none"> ● none 	<ul style="list-style-type: none"> ● self-selection ● low level of monitoring 	<ul style="list-style-type: none"> ● selection ● socialization
Informational requirements	<ul style="list-style-type: none"> ● information is codified, abstract and diffused 	<ul style="list-style-type: none"> ● information is codified, abstract and diffused 	<ul style="list-style-type: none"> ● information is not only abstract but also concrete, uncoded and then relatively diffused
Atmosphere (quality of the social relationship)	<ul style="list-style-type: none"> ● alienated 	<ul style="list-style-type: none"> ● partially alienated 	<ul style="list-style-type: none"> ● partially organic
Form of control	<ul style="list-style-type: none"> ● control is external ● shared values and trust are unimportant 	<ul style="list-style-type: none"> ● control is external ● shared values and trust are not excluded 	<ul style="list-style-type: none"> ● control is substantially internalized but can also be external. ● shared values and trust are necessary
Coordination	<ul style="list-style-type: none"> ● coordination is horizontal and self-regulating 	<ul style="list-style-type: none"> ● coordination is horizontal and self-regulating even though hierarchical and formal aspects are present 	<ul style="list-style-type: none"> ● coordination is horizontal and carried out through mutual adjustments ● hierarchical and formal aspects can be present
Goals	<ul style="list-style-type: none"> ● each player is free to pursue his/her own goals 	<ul style="list-style-type: none"> ● each player is free to pursue his/her own goals even though negotiations are not excluded 	<ul style="list-style-type: none"> ● goals are negotiated between players
Core institutional values	<ul style="list-style-type: none"> ● participation freedom 	<ul style="list-style-type: none"> ● participation freedom 	<ul style="list-style-type: none"> ● loyalty to a community

Note: Sourced by Spagnoletti et al. (2015)

Constantinides & Barrett (2014) focus on the challenge of combining heterogeneous interests and resources in the development of inter-organisational structures and argue that the functioning of the governance structure depends on achieving three types of legitimacy: pragmatic - finding common ground between the different interests -, cognitive - making the use of the platform familiar to users, achieving "taken-for-grantedness" -, and finally normative - making participants aware that the infrastructure is the right thing to do. In particular, in order to build legitimacy and provide the basis for the successful development of the platform, the authors claim that the involvement of all stakeholders in the development phases of the platform through constant dialogue is fundamental, ensuring that everyone's interests are represented. Indeed, if participants are denied the opportunity to contribute to decisions about the platform, they cooperate less voluntarily (Constantinides & Barrett, 2014).

3.4 Organizing blockchain-based digital platforms

Blockchain opens new possibilities for the development of inter-organizational structures, and it can potentially enhance the diffusion of cooperative forms of value creation within many industries, reducing complexity and costs among the value chain and increasing efficiency and

transparency (Ali et al., 2020; Chen et al., 2021; Kołodziej, 2019; Pereira et al., 2019). Davidson et al. (2018) go beyond this concept, stating that blockchain is not just a technology that allows the coordination of multiple entities, but it is a new way to coordinate economic activity.

This technology has the potential to build platforms which connect and coordinate different entities relying on a system which distributes authority and control power among community members without the presence of third-party control (Catalini & Gans, 2019; Halaburda, 2018; Vella & Gastaldi, 2021). Two main characteristics distinguish blockchain-based platforms: *trust* – since it allows the creation of a trusted environment without the need for third-party control over the relationship between participants – and *decentralization* – which refers to the possibility of not relying anymore on the management of an intermediary (Ali et al., 2020).

The application of blockchain doesn't affect only the governance system, but it also impacts the infrastructure level, moving from a centralized type of database – where data are owned and stored in a central structure – to a distributed one – which means that the database is stored among the network (Pereira et al., 2019). Another main difference regards the verification process of the data, which is not done by a central authority but is based on a pre-agreed consensus mechanism applied within a peer-to-peer system (Pereira et al., 2019).

Blockchain-based platforms differ based on their degree of openness and they can be divided into permissioned (or private) and permissionless (or public) networks. The difference is that permissionless or public networks are open, allowing everyone to join or quit the system through a self-certification system, while permissioned or private ones are closed groups that specifically select the participants (Garg et al., 2021; Stasi & Attanasio, 2021).

The literature stresses that the adoption of blockchain technology to build inter-organizational structures could help to overcome several barriers related to traditional centralized platforms such as the need to assign control power to a party and the low level of trust between participants (Catalini & Gans, 2019; Davidson et al., 2018; Kołodziej, 2019), the costs of intermediation (transaction costs) (Ali et al., 2020; Pereira et al., 2019) and the risks related to data privacy and network security (Ali et al., 2020; Catalini & Gans, 2019; Pereira et al., 2019).

However, the use of blockchain arises new challenges both on an economic and a technical level that must be carefully evaluated such as higher coordination and verification costs (Davidson et al., 2016; Garg et al., 2021; Pereira et al., 2019), the need of strong involvement by participants (Chen et al., 2021; Harris & Wonglimpiyarat, 2019), scalability and interoperability problems (Garg et al., 2021; Saheb & Mamaghani, 2021), the problematic application to physical assets (Catalini & Gans, 2019; Davidson et al., 2018), strategic and structural inflexibility (Malhotra et al., 2021; Pereira et al., 2019), the need of parallel management of multiple separated infrastructures and the fulfilment of the technical needs to run the blockchain technology (Saheb & Mamaghani, 2021; Vella & Gastaldi, 2021).

Furthermore, from a regulatory point of view, there are many aspects of blockchain technology that should be carefully evaluated such as governance and accountability, contract enforcement, data protection, privacy, and confidentiality (Herian, 2018; Malhotra et al., 2021; Stasi & Attanasio, 2021).

To conclude, even though there is great attention in the literature toward the possible application of blockchain to create inter-organizational structures, it is clear that this field of research is not mature, and a general theoretical orientation is missing (Ali et al., 2020). From an empirical point of view, the application of blockchain is fragmented and almost an unexplored field, few projects implemented on an industry level have reached an operative maturity (Saheb & Mamaghani, 2021; Vella & Gastaldi, 2021).

Researchers must investigate and develop more tangible contributions to this topic through the analysis of empirical applications of the technology. This is the purpose of the research which aims to enrich the current literature analysing the Spunta Banca DLT project and answering the research question:

How has blockchain been used to build a platform ecosystem within the Italian banking industry in the Spunta Banca DLT project?
Which are the main benefits and challenges?

4. METHODOLOGY

In this chapter, the methodology applied for this study and the rationale behind the decisions made is explained. Firstly, the research strategy and the research design are presented. Then, the methods chosen regarding data collection and data analysis are introduced. Finally, some considerations about the research quality are made.

4.1 Research strategy

Since the objective of the work is to investigate a new field of research – the application of blockchain on an industry level within the banking industry - which does not have significant previous literature and secondary data to analyse, a qualitative research strategy is the best way to address the research question because it allows for exploratory research through an inductive approach that tries to build up a theory from the analysis of data collected (Bell et al., 2018).

A qualitative approach guarantees flexibility and adaptability, which are fundamental elements to investigate a new field. It emphasizes the use of a loosely structured approach to allow the researcher to adapt the research structure iteratively based on the findings gathered throughout the work (Bell et al., 2018). This type of strategy favours words and images rather than quantitative data and it is particularly suitable for the scope of this research that aims to gather insights about the potentialities of the blockchain technology from the in-depth analysis of a prominent case study based on the collection of information from people involved in the project.

4.2 Research design

The research design defines the guidelines for the research method – the technique of data collection - and the subsequent analysis of data gathered (Bell et al., 2018).

The selected design is the single case study design as the research concerns the in-depth analysis of the Spunta Banca DLT project. The emphasis of this type of design is the provision of a detailed and intensive examination of the case and it is very well suited to the use of qualitative research methods such as interviews, which allow gathering deep insights that quantitative analysis often fails to capture (Bell et al., 2018).

According to Stake (1995, as cited in Bell et al., 2018), the selection of the case of interest should be based on the expected opportunity to learn from it. The rationale behind the choice of the Spunta Banca DLT project is that it represents a worldwide unicum in the field of the application of blockchain implementing the technology at the industry level within the banking sector for the management of back-office operations between banks. The detailed analysis of this case can provide important insights that can be very useful for future projects in this field and important addition to the existing literature on the use of blockchain forming the basis for future theoretical analysis (Bell et al., 2018; Siggelkow, 2007). Thus, it can be categorized as an *instrumental case study* that aims to provide a deeper understanding of the application of blockchain technology within the banking industry (Bell et al., 2018).

The main criticism of the use of a single case study methodology is to have a too-small sample to be representative and generalizable. However, even if for a single case study is difficult to obtain a theoretical generalization, it is possible to produce “*moderatum generalization*” or “*case-to-case transfer*”, which refers to “*to make generalization from one case to another one*” (Bell et al., 2018, p. 398). Indeed, the goal of the case study is not to be representative, but to “inspire” providing a deep look at something unique which can pave the way for new perspectives and possibilities (Siggelkow, 2007).

4.3 Research method

Based on the selected research design – the single case study - the research method chosen for this work concerns both the collection of secondary data to conduct a literature review and above all the collection of qualitative primary data that allows the detailed analysis of the case. In the following sub-sections, the literature review and primary data collection methods are explained.

4.3.1 Literature Review

Secondary data were collected to carry out the literature review, which has a threefold purpose: to summarise the main findings of the research field in the existing literature, to validate the relevance of the research aim and the research question, and to provide a theoretical background to be used in the interpretation and analysis of the primary data and the development of findings.

A narrative review approach was chosen, which allows flexibility in the search and selection of material to be included in the literature review without having to define a priori strict criteria and to comply with rigorous methodological requirements (Bell et al., 2018). The narrative literature review is considered more suitable for qualitative and inductive research dealing with a new field of research where the existing literature is fragmented and not very coherent as it allows a flexible and iterative approach during the evolution of the work (Bell et al., 2018).

The material relevant for the construction of the literature review was searched through the use of different databases such as Scopus, Web of Science, Google Scholar, University of Gothenburg Online Library and LUISS University Online Library. The search was done using different keywords, with the aim of identifying the articles that best fit the purpose of the research. The main ones were: “Blockchain”; “Distributed Ledger Technology”; “Digital Platform”; “Platform Ecosystem”; “Governance”; “Banking”. The material selected included mainly peer-reviewed articles, but also technical reports and website articles considered reliable and relevant for research.

4.3.2 Primary Data Collection

Primary data were collected through qualitative interviews, which is the most widely used method in qualitative research because it enables an in-depth analysis of the chosen topic of research (Bell et al., 2018). In particular, the *semi-structured interview type* was chosen because it allows following a specific pattern of conversation and an easier comparison between the different interviews following a general interview guide, but at the same time it guarantees a certain degree of flexibility both to the interviewer and the interviewee to move apart from the guide and deepen interesting concepts or thoughts that arise during the interview (Bell et al., 2018).

The structure of the interview guide - Table 4 below - was kept to a minimum asking general questions to increase the ability to gather genuine perspectives from the interviewees not imposing a predetermined frame of reference. The interview was divided into four main phases, each introduced with a very general question. Each phase is aimed at analysing specific aspects. Based on the answers of the interviewees, further questions were asked to clarify or deepen the concepts exposed.

Table 4 - Interview Guide

Period	Starting Question	Aspects
Warming up	Describe me your position and your role in the organization	The research (background, purpose, methodology) Reassurance on compliance with anonymity criteria The interviewee (position, tasks, work)
Exploration of the case	Describe me Spunta Banca DLT project from your point of view	Differences between old and new system Development of the project Main factors of success of the project Main challenges encountered
Exploration of future possibilities	How do you think the project can evolve?	Scalability of the project New projects under development Possible applications of the technology
Finish	Do you have any other comment to make?	Final thoughts Clarification of sending analysis results and request for feedback Acknowledgement and leave-taking

Note: Elaborated by the author

The interviewees were chosen through a generic purposive sampling, which is a method particularly suitable for qualitative research. Indeed, it is a non-probability form of sampling that does not aim to represent a population, but it establishes as the main selection criterion the relevance to the research purpose to identify knowledgeable respondents who can provide an important contribution to the field of interest (Bell et al., 2018). According to the scope of this research, employees and managers of the companies involved in the Spunta Banca DLT project were selected. In particular, since the aim of the research was to investigate the development of the platform ecosystem created, taking into account the points of view of the different actors involved, the sample aimed to comprehend representatives from all levels of governance of the project.

The candidates selected were contacted by email to ask about their availability for an interview and eventually to schedule the interview date and place (online or face-to-face). Ten companies agreed to take part in the research out of the 18 founder participants of the project. Among these 10, all the levels of governance were represented: Business Network Governor, Business Network Designer, Business Network Operator (BNO)/DLT Network Provider (DNP) and 7 out of the 14 founding banks as Business Network. The governance level not represented is the "Platform" one, the latter being a purely technical level relating to technology and therefore not influencing the aspects related to the governance and organizational development of the platform, thus not relevant for research purpose. Both managerial and operational figures were interviewed.

In Appendix B, it is possible to find the details of the different interviews: level of governance, role in the company, date and place. The names of the participants and the companies to which they belong have been omitted to comply with anonymity and confidentiality rules. However, since some levels of governance are covered by a single company, the complete anonymity of some participants is not guaranteed. Before each interview, it was specified that all data collected are treated following the criteria of anonymity and confidentiality.

The interviews were conducted in Italian, to allow the interviewees to express themselves in their mother tongue and thus be more comfortable.

It was asked to record the interview for transcription purposes. The interviews were fully transcribed and subsequently translated into English. The transcription of qualitative interviews is important because it allows a deeper and better examination of what respondents said reducing the biases due to memory and intuition's limitations. In addition, the transcription improves the reliability and validity of the work because it enables secondary analysis opening up the data to public scrutiny (Bell et al., 2018).

4.4 Data analysis

The analysis aims to expand the knowledge about the application of blockchain in the creation of a platform ecosystem within the banking industry through the in-depth analysis of the Spunta Banca DLT project and to pave the way for future research about the potentialities of this technology.

The data analysis followed the thematic analysis framework, which is based on the development of a coding system that emerges inductively from the analysis of the interviews' transcripts (Bell et al., 2018). Thematic analysis is regarded as the most suitable method for qualitative analysis because it entails a certain degree of flexibility necessary to study different types of unstructured data, but at the same time provides a general structure to carry out a comprehensive and coherent analysis through the coding process (Bell et al., 2018).

Coding is a multi-level analysis system that involves the review of the interviews and the identification of salient insights that build the final findings of the study (Bell et al., 2018; Gioia et al., 2012). In particular, the first level of coding concerns the in-depth analysis of the individual interviews and the identification of concepts of interest – the empirical themes - that

reflects the respondents' view. The concepts identified in the different interviews are then compared with each other to pinpoint patterns and common themes according to two main criteria: the repetition across interviews and the relevance to the focus of the research and the research question. The results of the combination of the empirical themes are the conceptual categories, which represent theoretically distinct concepts. Finally, the last step involves the aggregation of the conceptual categories in aggregated dimensions, which represents the main themes of the analysis based on the insights found in the literature and the research purpose (Gioia et al., 2012). Appendix C shows the results of the coding process, while Appendix D provides exemplary quotations for the different conceptual categories.

To simplify the coding process, memos were taken during the interviews to highlight perceptions and insights that were considered during the analysis of the transcripts.

4.5 Research quality

A main objective of the research is to be able to convince the audience of the significance and credibility of the conclusions provided and this is based on the quality of the research (Bell et al., 2018; Siggelkow, 2007). According to Lincoln and Guba (1994, as cited in Bell et al., 2018), the quality of qualitative research depends on two main values: trustworthiness and authenticity.

The authenticity concerns the social and political impact of the research, and it is not relevant to the scope of this work since it is more related to other social sciences fields and different types of research such as action research (Bell et al., 2018).

Instead, the trustworthiness groups different criteria that are the equivalents of the criteria used in the quantitative research (reliability, replicability, and validity) adapted to the specific characteristics of the qualitative type. It is composed of four main criteria: credibility, transferability, dependability, and confirmability (Bell et al., 2018). The following sub-sections provide a description of each of these four criteria and the actions taken during the research to guarantee them.

4.5.1 Credibility

The credibility of findings can be defined as the capacity of the research of being accepted and correctly understood by the social world it belongs to. It can be obtained by the technique of respondent/member validation, which entails the provision of the findings to the research participants to get their validation (Bell et al., 2018).

For this reason, before each interview, it was provided with the respondents with a summary of the research's objectives and the finding until that moment and at the end of the work, the conclusions were shared with all participants.

4.5.2 Transferability

Transferability refers to the possibility to generalize the findings derived from the analysis (Bell et al., 2018). Since this research is based on a single case study, it is strictly related to the uniqueness of the context of the study. The application of the criteria of generalizability to case study research has been widely discussed in the literature and most authors agree that the goal of case study analysis is not to be representative of other cases but to provide “concrete, context-dependent knowledge” focusing on the uniqueness and the complexity of the selected case (Bell et al., 2018; Siggelkow, 2007).

The context's characteristics were carefully highlighted throughout the work to allow readers to understand the case's specific conditions and to evaluate the transferability of the findings in the contexts they are interested in – obtaining the so-called “case-to-case transfer” explained in section 4.2 about the research design.

4.5.3 Dependability

Dependability entails the use of an “auditing” approach which ensures the accessibility and the evaluation of the different phases of the research through the complete recording and provision of all information (Bell et al., 2018). Thus, all the documents gathered and produced during the work were collected and stored to enable a possible revision of the material.

4.5.4 Confirmability

Confirmability concerns the extent to which the analysis and the findings are influenced by the researcher's values and theoretical inclination (Bell et al., 2018). Indeed, in qualitative research the risk that the results are biased by the subjectivity of the author is high.

To mitigate this risk, a structured analysis of data based on different degrees of coding was applied and the different levels of analysis with exemplary quotations were provided in Appendix C and D to allow readers to evaluate the conclusions derived from the data and the reasoning process of the researcher. In addition, full transcripts of the interviews have been stored by the author and can be provided on request.

5. FINDINGS

This chapter presents the findings of the analysis conducted. It is divided into 5 parts, each corresponding to one of the key dimensions identified through the coding process. Each dimension is based on the aggregation of the different conceptual categories identified during the analysis of the data collected through the lens of the literature presented. The objective of this chapter is to fulfil the research purpose and provide the necessary information to answer the research question.

5.1 Platform Governance

This first section deals with the issue of platform governance. The governance structure is considered in the literature to be a central element of differentiation between platforms as it defines the roles, responsibilities, and processes in the system and therefore influences all aspects regarding the operation of the platform and its coordination and value creation mechanisms (Aulkemeier et al., 2019; Mukhopadhyay & Bouwman, 2019). Governance is a relevant issue within the analysis of the Spunta Banca DLT project since the platform adopts an innovative governance model enabled by the use of blockchain technology.

From the analysis of the interviews, three main sub-themes related to this aspect have been identified, which will be analysed individually: the clear definition of roles and responsibilities within the system, the decentralisation of control power, and the cooperation between different actors.

5.1.1 Roles and Responsibilities

As regards the definition of roles and responsibilities within the system, several respondents pointed out that the establishment of a clear governance model, defining and regulating the roles and relationships between the different parties involved, was one of the main factors of the success of the project. For example, Interviewee I stated that:

“It worked not only because it was possible to implement this technology, but also and above all because there was good direction and good identification of roles and relationships between those involved in the project”.

And, similarly, interviewee B said:

“One of the success factors was to have defined a clear governance model”.

The importance of a clear governance model lies in the ability to identify precisely and easily the boundaries of accountability, there is a clear definition of everyone's role and of the actions that each actor has to perform, and this is an essential element for the success of the project. In this regard, the Interviewee C stated:

“With a governance system designed in this way, it is very clear where the boundaries are, what I have to do, what the software developer has to do, what ABI Lab, which governs the system, has to do, and so on”.

As explained in section 2.3 (Spunta Governance), six governance levels were defined within the platform, each of which foresees a precise role and functions. According to the interviewees, these levels are necessary for the correct governance and functioning of the system. Excluding the “platform” level, which is a merely technical role of defining the technology to be used, and the “business network” level, which represents the actors that use the platform, the other four levels are essential for the proper development of a digital platform. There is the need to define:

1. A federating subject, who is the actor that involves the adherents, that federates the participants, that autonomously or through a consortium consultation mechanism of participation of its members defines the functional rules that must then be implemented in the smart contracts in the application.
2. An entity that deploys the infrastructure and provides a solution that meets the requirements of all participants.
3. A party that develops the software on which participants can operate.
4. An entity that takes care of the support services manages the applications, ensuring the operativity of the system.

These roles may overlap and be performed by the same entity, but they must all be present for the success of the project.

5.1.2 Decentralization

Another key factor for the success of the project that emerges from the interviews concerns the adoption of a decentralised governance model. The interviewees pointed out that the idea of decentralised governance is essential in the development of platforms that use blockchain

technology. Often, a major flaw in projects that implement this technology is that of creating a distributed infrastructure, but adopting centralised governance, since a conflict arises as the main benefits offered by the technology itself are lost in this way. For instance, respondent A stated that:

“We realise that many blockchain projects are wrecked because there is no idea how to manage governance, because the concept of decentralising a process, leaving a single decision-maker and centralising decision-making, is a bit of nonsense”.

And, in the same fashion, respondent B claimed:

“There must be a desire to manage things in a decentralised way. For instance, if you make a blockchain but then there is only one company that manages everything, this could have been done with a centralised infrastructure”.

Furthermore, it is important to highlight that ABI Lab, as Business Network Governor, was able to take on a facilitating role within the project, coordinating all the actors involved in the project without ruling, letting all decisions be taken jointly by all network actors. For instance, respondent A, an employee of ABI Lab, stated:

“From our point of view, we are not the decision-makers of anything, but we always decide together with the participants - this is our role as facilitators, i.e., in the sense of putting together a bit of what the ideas are and trying to find a solution together with the participants”.

5.1.3 Cooperation

A potential problem with the decentralised governance model highlighted in the literature is the need for a high level of involvement between parties (Chen et al., 2021; Harris & Wonglimpiyarat, 2019). The interviewees themselves were aware that a major challenge was to bring together actors who usually compete. The creation of an ecosystem, a community where all actors cooperate to achieve a common goal, is central to the use of blockchain technology. For example, Interviewee B stated that:

“The first big challenge projects of this kind must overcome is to create the ecosystem. Very often the hardest thing is to get actors who are in competition to collaborate, create a decision model and make everyone happy”.

And accordingly, Interviewee C said:

“A blockchain system works if there is a community, i.e., if there are a plurality of actors sharing a process and a goal”.

The success factor was the strong cooperative spirit demonstrated by all parties, who proved to be very involved and cohesive in the attempt to reach an industry solution, showing flexibility, negotiation skills, and empathy. The shared feeling that led to this strong cohesion between the participants was the belief that they were trying to achieve an important system-wide solution from which all the banks could benefit as a sector. In this sense, the words of respondent F1 are emblematic:

“The success factor is always to be found in those people who have a vision of how the world is going and also the ability to negotiate, to relate and to empathise [...] undoubtedly making an ecosystem where competition is no longer between banks, but between the Italian banking system and Big Tech companies, because Big Tech are coming. Taking a cue from the concept of 'co-opetition', there is indeed competition between banks, but if certain things are done together, we can save on investment, we can reduce time, and we can better mitigate risks”.

In addition, respondents emphasised that ABI Lab was able to foster a collaborative climate by ensuring the involvement of all parties and making each actor feel important and on the same level as the others. For instance, F2, an employee of one of the banks, stated:

“I can say that perhaps the most unique element for me was working together, all as equals, getting together with so many colleagues and deciding together what to do. [...] ABI Lab considered all banks as being equal. This may not even be the case because there are bigger banks and smaller banks”.

Thus, an important element of facilitation in the collaboration between the parties is to guarantee equality within the decision-making process to ensure that everyone's interests are represented.

5.2 Platform Set-up

This second section deals with the platform set-up, analysing the main elements that contributed to the project's success. This topic is particularly important for the research because it allows to highlight the conditions and practices that led the Spunta Banca DLT project to become operational within the Italian banking sector and thus provide interesting insights into potential success factors in the development of similar projects. Four main themes emerged from the analysis: the conditions that fostered the development of the project, the integration between the different participants, the education of the actors to the new system through testing, and the issue of regulation.

5.2.1 Case Drivers

Starting from the background conditions that favoured the development of the project, as outlined in the previous section, it emerged from the interviews that there was a strong desire within the banking sector to experiment with cutting-edge technology such as blockchain, as it was considered capable of providing important benefits to the entire sector. However, the actors themselves were aware that blockchain was a frontier technology, very innovative but at the same time very unstable and with important operational constraints that needed to be carefully assessed. For instance, interviewee C stated:

“The technology is very innovative, still very unstable, and it has very big operational constraints in terms of performance, capacity, deployment, and all this was a barrier on the distribution and deployment of applications which applies it”.

For this reason, the participants chose to start with the interbank reconciliation process (Spunta), which presented ideal characteristics to test the technology without taking excessive risks concerning the banks' businesses:

- It is a back-office process, which does not involve customers, and therefore could not have a direct impact on the relationship with customers and consequently on the banks' business.

- It is not related to the area of commercial competitiveness between banks, and this has facilitated cooperation between the different actors.
- It is a relatively simple process from an operational point of view and it already involved the existence of shared registers between banks, hence it was perfectly suited to the adoption of blockchain technology.
- It is regulated by ABI Lab, the same association that promoted the Spunta project, so from a regulatory point of view, the adaptation was quite easy.
- It was a process with very cumbersome and outdated procedures, which required updating and streamlining, as well as standardisation at the industry level as each bank used different methods and software.

Therefore, these specific features related to the Spunta process were an important driver for developing and implementing the project within the banking sector.

Furthermore, another driving factor was the fact that the adhesion to the project by all banks was very easy because the previous process was already subject to a unique and compulsory way of adhesion and therefore banks were already willing to share a common procedure. For instance, respondent I stated:

“Mentally, the banks were already aligned with the fact that in replacing something that was regulated in this way - a unique and compulsory procedure for participating in the Spunta process - even this had to be more or less subject to an adhesion that was, let's say, not exactly compulsory, but very "pushy", and this is an element of strength compared to projects that were characterized by completely voluntary adhesion”.

5.2.2 Integration

Moving on to the analysis of infrastructure development, from the interviews it emerged that the issue of integration was a major challenge for the project since within the Italian banking system there was a lack of standardisation in terms of internal procedures and substantial differences in terms of technological level, also due to the different size of the banks involved. To make the new system work, it was essential to integrate the procedures of the different banks and to ensure that all of them had the same operational capacity. For instance, interviewee C stated:

“For an application such as Spunta Banca DLT to work, it is essential that all parties have the same operational capacity in the system, because if there is a bank that can manage its information, its node, its ledger and another bank is not, even the former bank is affected because the lack of operational capacity of the weaker party also affects the operation of the other party”.

To overcome this challenge and enable the integration of the systems, the technological partners (NTT Data and SIA) developed an integrated service solution for all banks that allowed each to manage its node and run its application, but on a system that was centrally managed at a technological level to guarantee operability. In this regard, the hard work was to gather input from each bank, through individual meetings, and then define common standards that would suit all participants. For example, respondent C, manager of SIA, claimed:

“There was a need for someone to take charge of putting everyone at the same level of operational capacity, to give everyone a service solution that would allow everyone to manage their node and run their application, but on a technological system that was managed centrally to guarantee its operation”.

and respondent B, manager of NTT Data, declared:

“A major challenge for us was to manage the input (requests) from dozens of banks and to design a solution that would fit the entire banking sector, and therefore be integrated within the entire banking sector. Technologically speaking, the challenge was very strong”.

The key strength of the developed solution was centralising the development of the solution and the management of the technological issues. Centralising the development and the technical management of the shared infrastructure in a single technology provider made it possible to define a solution that took into account the needs of all parties involved and, at the same time, relieved the banks from having to worry about the integration and operation of the system since they were provided with a turnkey solution and the shared infrastructure is controlled and managed by a single entity. For instance, Interviewee C stated:

“By doing this type of integration we have brought a completely turnkey solution, so no bank had to worry about the shared infrastructure. The integration of the banks' legacy systems was

all in all very simplified [...] Concentrating the technological issue on one subject instead of distributing it and making it a problem for all banks is the key to the success of applications of this type that involve communities of subjects because when we solve it, we solve it for everyone”.

and this was confirmed by interviewee G1, manager of one of the banks, who declared:

“We never got into the technology issue and we use the application without let's say knowing how it works behind it. In short, we care that it works”.

Furthermore, another important aspect highlighted by the interviewees was that the banks were flexible in deciding how to configure their node, either in-house or using a third-party provider, and how to manage it. This allowed each bank to adapt the technology to its needs and enabled everyone to have their node, their ledger, on which they could upload their data and perform their matching operations.

5.2.3 Test and Learn

Another challenge to the use of blockchain that the literature highlights is the lack of knowledge and understanding of the technology (Saheb & Mamaghani, 2021; Spahiu et al., 2021) which is closely linked to one of the barriers to the success of inter-organisational platforms, namely the capacity of all actors to fulfil their tasks (Adner, 2017). Among the project participants, there was awareness of this challenge as demonstrated by Interviewee B's quote:

“One of the main reasons why these projects often didn't go into production phase is because people didn't ultimately understand either the technology or the benefits of it”.

For this reason, a “Test and Learn” approach was adopted, foreseeing a long and structured testing phase before going into production, which involved all actors from the outset, so that adaptation to the technology was gradual and by the time it reached the production phase all participants were familiar with the new system. In this regard, Respondent E2, an employee of one of the banks, said:

“Let's say that we had trained during the test phase where we tried to do the various operations, so the adaptation was easy because by the time it went into production, we already knew the system”.

Therefore, through a long test phase and the involvement of the entire business network from the early stages of testing, all actors went through an education process, having the opportunity to know and understand the technology in a gradual and guided way, and once implemented in the project they were able to use the application easily and consciously.

In addition to educating the actors, the long and structured testing phase also allowed to test the system's operability and assess whether the blockchain infrastructure could handle the massive amount of data transmitted. The system initially had a significant number of bugs that compromised its ability to handle the information transmitted, but through joint work between the various technical players it was possible to work on the platform, significantly improving performance and ensuring stability.

5.2.4 Regulation

From a legal point of view, the interviewees emphasised that the success factor in overcoming the legal challenge of the technology was the involvement and cooperation of all stakeholders around this issue from the early stages of the project. During the pre-production phase, a significant in-depth legal study was carried out through the establishment of a working table between the lawyers of each bank, coordinated by ABI Lab's legal department, which made it possible to discuss and define all the legal aspects and to draw up a single contract signed by all the parties regulating the system. For instance, respondent I, manager of one of the banks, stated:

“The other important thing is the legal in-depth analysis conducted. We had many meetings with the lawyers involved by ABI Lab and with the lawyers of each bank, so when it came to signing the contract, all the legal aspects had already been dealt with and defined, and no doubts were left open about legal and compliance issues. There was at least one good quarter, the first quarter of 2019, at least until May, while the technical project had continued to move forward in parallel, when specific working tables were held on this subject”.

In addition, as the banking sector is highly regulated, the legal aspect related to the use of technology is also accompanied by the issue concerning the need for regulatory adaptation. In the specific case of the interbank reconciliation (Spunta), the process of regulatory adaptation was straightforward since ABI Lab, the promoter of the project is also the regulator. However, it emerged from the interviews that for the development of projects of this kind, it is important to have an alignment from a regulatory point of view, as stated by Respondent D:

“The coordination of different actors, both private and public, banks, technological partners, and the supervisory authority itself, to redefine the regulatory profiles is fundamental. I must say that from this point of view ABI Lab did an extraordinary job of coordination, but it was a non-trivial hurdle at the outset”.

5.3 Platform Benefits

The third section deals with the benefits derived from the adoption of the Spunta Banca DLT application within the Italian banking sector. The objective is to pinpoint the main benefits that have been experienced through the implementation and use of the new system.

This section is closely related to the next one, which deals with the challenges arising from the use of the new system. For both factors - benefits and challenges - a distinction was adopted, based on the one proposed by Saheb and Mamaghani (2021), which classifies them into technological and organisational. Technological factors refer to the specific technical characteristics of the technology and the benefits or challenges they entail, whereas organisational factors concern the dynamics within the system caused by the use of the new technology (Saheb and Mamaghani, 2021).

5.3.1 Technological Benefits

As regards the technological benefits, respondents agreed that the new system provided a significant gain in efficiency through the automation and standardisation of the process, simplifying and speeding up the transactions flow management procedure and reducing operational costs. The gain in efficiency was great also because the previous procedure for managing interbank reconciliation was old and quite outdated.

Moreover, the new system ensured an improvement in terms of timeliness, as the procedure is now handled daily, whereas with the old system the handling was done on a monthly basis.

To conclude, it emerged during the interviews that the automation and day-to-day management of the Spunta process significantly reduced errors during the transaction matching process.

5.3.2 Organisational Benefits

Moving on to the organisational benefits, a central theme that emerged from the analysis of the interviews is the transparency and traceability of information. The new system allows all participants to have full visibility of matching operations in real-time, which was previously reserved only for the bank that was in charge of managing the reconciliation process in that period. Under the new system, everyone can access the platform and monitor the progress of the process at any time.

Moreover, it was pointed out during the interviews that the use of blockchain has enabled the adoption of a decentralised system, where there is no single entity that has control power within the platform, rather the power is shared by all participants. This facilitated the development of the platform because it removed the need to find an entity on which to centralise decision-making powers. All participants felt involved in the decision-making process and were able to advocate their interests.

The features of increased transparency and distribution of decision-making power also increased the level of trust between the participants, who were more inclined to cooperate.

Furthermore, the new system has ensured an improvement in terms of coordination capacity and ease of communication between the different actors. This was enabled by the creation of a shared platform that connects the different participants in real-time and allows for communication within the application, removing the need to use unstructured forms of communication such as calls or e-mails.

To conclude, another element that emerged during the interviews is the sharing of the investment. Indeed, the creation of a shared platform within the banking sector allowed banks to share the investment in the exploration of this new technology and thus the risks associated

with such exploration. This can be seen as a potential incentive to adopt a pioneering attitude towards new technology.

Table 5 below summarises the benefits that emerged from the analysis of the interviews and provides an exemplary quotation for each benefit.

Table 5 - Benefits

	Benefits	Exemplary quotations
T e c h n o l o g i c a l	Process simplification	<i>"The new system certainly simplified a procedure that was very old and archaic" (G1)</i>
	Process automatization	<i>"The benefit of the banks is huge because they have fully automated this process" (C)</i>
	Increased efficiency	<i>"This platform also gives us a gain in terms of increased efficiency in process management" (D)</i>
	Reduction of operational costs	<i>"The new unique platform allowed us to reduce the internal costs of managing this process" (D)</i>
	Increased timeliness	<i>"Another upgrade was the move to daily management of the process instead of monthly" (H1)</i>
	Error reduction	<i>"The fact of digitising processes, of automating processes, clearly leads to a drastic reduction in errors" (A)</i>
O r g a n i z a t i o n a l	Better coordination	<i>"The blockchain system makes it possible to improve the coordination of processes between different actors" (C)</i>
	Decentralization	<i>"This is a technology that effectively frees you from the need to have a single provider controlling and managing the platform" (D)</i>
	Increased transparency	<i>"From the point of view of the benefits of technology, the issue of transparency and traceability of information is obviously central" (A)</i>
	Enhanced trust	<i>"The system enhanced the concept of trust, the concept of truth, between the parties"(F1)</i>
	Easier communication	<i>"Through Spunta Banca DLT it becomes much easier to communicate with the counterparty" (J2)</i>
	Sharing the investment and the risks associated	<i>"A very interesting element of this initiative was the sharing of investment by the participants" (D)</i>

Note: Elaborated by the author

5.4 Platform Challenges

This section presents the findings concerning the challenges related to the platform, its features and its operations highlighted during the interviews. The challenges, as explained in the previous section 5.3, are divided into technological and organisational. The objective of this

part of the analysis is to highlight the critical issues encountered in the development of the project and the solutions adopted if any.

5.4.1 Technological Challenges

Concerning the technological dimension, the analysis of the interviews revealed that the main challenges encountered are related to the scalability and performance of the platform. The interviewees emphasised that in the tests carried out at the beginning of the project, there was a great difficulty for the system to handle the huge amount of transaction data whilst ensuring an adequate level of performance, and this had caused considerable concern. To solve this problem and enable the application to adequately handle the data flows, a lot of time and work was required on the technology and the infrastructure by the technology partners. This was a great challenge considering that Spunta Banca DLT is the private blockchain platform that handles the largest number of transactions in the world.

Going further, the other issue that emerged during the interviews concerns the immutability of data that characterises blockchain technology. Although data immutability is considered an advantage in terms of platform security, it inevitably entails inflexibility from an operational point of view. This implies that if there is a need to change the data entered into the system, this is particularly difficult since all the elements are chained together. Therefore, if a mistake is made during the loading of data, the procedure to correct this error is much more complex than with the previous system.

Another consideration is related to the issue of interoperability. Respondents regarded interoperability as one of the main technological challenges to be addressed, given that different blockchain systems currently cannot communicate with each other and this hinders the deployment of this type of systems. For instance, it emerged from the interviews that a long-term goal is to enable communication between different blockchain infrastructures, as it is impossible to think of having one single infrastructure worldwide for all industries, but one can think of several infrastructures that can communicate with each other, cross-platform, cross industries.

Moving on, another issue highlighted during the interviews is the economic investment required to develop a system based on blockchain technology. The interviewees pointed out that blockchain technology requires very high equipment and set-up costs both to develop the

common infrastructure and to implement the peripheral infrastructures (nodes) at the different participants. In this regard, the solution adopted by many participants was to rely on third-party companies that offered to rent the infrastructure needed and support banks in the creation and management of their nodes. In addition, a mixed pricing model was defined within the system, according to which banks pay a fixed fee for the common infrastructure and a variable fee based on the number of nodes owned and the usage in terms of the amount of data exchanged so that the cost is commensurate with the effort each bank demands from the system.

5.4.2 Organizational Challenges

Moving on to the organisational aspect, according to the respondents, the first and main challenge in the development of a platform of this kind is to overcome the initial reluctance to use new technology and to get all actors involved, since the adoption of a new system that differs greatly from the previous one inevitably generates mistrust and resistance to change. In addition to this, another issue that was feared to be a major barrier concerned the coordination of all banks, which had different situations, capabilities, and needs. In this regard, the advocacy and coordination work carried out by ABI Lab was crucial to achieve the full involvement of all participants and nimbly overcome these barriers, as explained in the previous sections 5.1 and 5.2.

Another central issue that emerged from the interviews concerns the need to redefine and align the regulation to the new process. This issue has already been analysed in section 5.2.4. To briefly summarise, for a successful implementation of a platform like Spunta Banca DLT there needs to be an alignment between the adoption of the new system and the redefinition of the regulatory framework governing the process managed by the new system. This inevitably requires coordination between the public and private sectors. However, in the specific case of Spunta Banca DLT, this alignment was very straightforward since the promoter of the project was also the regulator.

Table 6 below summarises the main challenges that emerged from the analysis of the interviews and provides an exemplary quotation for each challenge.

Table 6 - Challenges

	Challenges	Exemplary quotations
T e c h n o l o g i c a l	Scalability limitation	<i>"There are scalability problems, especially on the volumes that the system handles" (A)</i>
	Performance constraints	<i>"The application had some major performance problems that we really had to devote a lot of time and resources to try to resolve" (C)</i>
	Operational inflexibility	<i>"If there is an error within the system, it is very difficult to remove that critical element because all the elements within the system are chained together" (F1)</i>
	Interoperability issue	<i>"The challenge is to succeed not only in having a blockchain infrastructure, but also to make it possible for several infrastructures to communicate with each other" (A)</i>
	Expensive technological infrastructure	<i>"It is a process from a technological point of view very expensive and very heavy ... blockchain technology has high equipment and installation costs" (G1)</i>
O r g a n i z a t i o n a l	Reluctance to use a new technology	<i>"The first challenge was to get each of us to accept the fact that we had to deal with this new technology, which was certainly unclear at the time, and there was little confidence that it could be worth it" (I)</i>
	Coordination of multiple actors	<i>"Coordination of different actors, several banks, several technology partners and the supervisory authority itself has been challenging" (D)</i>
	Redefinition and alignment of the regulation	<i>"A major challenge concerns the regulatory issue, clearly there is always a bit of a debate on the issue of regulation that fails to keep up with the pace of technology" (A)</i>

Note: Elaborated by the author

5.5 Beyond Spunta

In this final section, the potential of the Spunta Banca DLT project and the infrastructure developed and how they may evolve are discussed. The aim is to understand the value of the project, both present and, above all, future, providing interesting insights that emerged during the interviews. Three main themes emerged from the analysis: the geographical expansion of

the project, the operational expansion of the project and the technology, and the tight relationship between blockchain and the concept of ecosystem.

5.5.1 Geographical Expansion

As regards the geographical expansion of the project, this is the hottest topic among the possible evolutions of the Spunta Banca DLT project, since, as reported by Interviewee A, the “Spunta Estero” project has already concluded the analysis phase, the development phase is now starting, and ABI Lab, the promoter of this project as well, wants to go in production by the end of 2022. This project aims to extend the perimeter of the Spunta system by collecting the interbank reconciliation that takes place with foreign banks. The interviewees emphasised that Italian banks, especially the larger ones, have strong relationships with foreign banks and therefore extending the reconciliation system with them would be very important as it would allow for process uniformity and to achieve absolute efficiency concerning the Spunta operation. For instance, Interviewee D, manager of one of the banks, stated:

“Reconciliation with foreign banks would be very important because it would give a uniformity of process that would allow us to achieve absolute efficiency”.

However, even though Interviewer A was very confident about this possible expansion abroad, setting the ambitious goal of reaching the production phase by 2022, other interviewees seemed more sceptical about it, claiming that integration with foreign banks is not so easy to achieve. Indeed, according to Interviewer G1 geographic expansion is complex as there is the need to involve entire foreign banking sectors due to the cost of infrastructure development. He made an example involving the German banking sector:

“As long as the entire German banking system is not integrated into the system we will not be able to work cross-border with our foreign correspondents on the system. Because let's say a german company wants to join us within the Spunta Banca DLT system, it would become too onerous for them to create a proprietary blockchain structure to be able to dialogue with the Italian system, and they could only do so if the entire German system took up this technology”.

Another potential barrier highlighted is that abroad there are other solutions for managing this type of processes, sometimes even with better performance than the Spunta Banca DLT system, as stated by respondent E1:

“It would be a good idea to expand the system abroad but there are other platforms that reduce the operation time even more”.

Thus, even though respondents agree on the benefits in terms of process efficiency that would be brought by involving foreign banks in the platform, there is no common view on the ease of such involvement.

5.5.2 Operational Expansion

Moving on to the potential concerning the operational aspect of the system and the technology itself within the banking sector, two main themes emerged from the analysis of the interviews: the improvement of the current system and the application of the technology to create similar systems in other areas of the banking business.

Regarding possible improvements to the current system, the most prominent topic highlighted by the respondents is the archiving of old data. This issue concerns the scalability and performance challenges - highlighted in the sub-section 5.4.1 - since one of the key reasons why these challenges arise is that in a blockchain application each data entry remains within the system as it is concatenated to the previous and the next, and this results in the database becoming infinitely larger, inevitably causing the application to become cumbersome and performance to decrease. For instance, Interviewee G1 highlighted the need to define a procedure to remove old data:

“All the old data have to be archived because a whole series of difficulties are being encountered due to the amount of data stored and therefore the heaviness of the archives that would have to be kept”.

Interviewee C declared that they have been working for months on the procedure to archive old data, and the goal is to define a method to clean the chain from obsolete data without hampering the system's operation. He stated:

“We were the first ones to raise the issue of archiving data that was too old, and it is a very complex procedure. We have been working on it for a few months now and we should be almost at the solution by now”.

The archiving of old data would allow the platform to handle increasing amounts of data solving the problem of scalability, hence it would be a key improvement for the development and expansion of the system. In addition to this, the definition of an archiving mechanism would provide a very interesting use case for possible applications in other areas using blockchain technology.

Besides the archiving of old data, the other improvements currently underway in the system concern more technical aspects of the Spunta procedure such as the closing of accounts or the possibility to communicate between banks that do not share accounts, whose procedures within the application are not yet fully defined.

Regarding the application of the technology and the development of similar systems to other processes within the banking industry, several insights emerged during the interviews. The most recurring theme, and the one with the most tangible developments at the moment, concerns the application of blockchain technology to banking and insurance guarantees. This area is currently managed entirely manually and could benefit enormously from digitisation through the adoption of a blockchain system. Moreover, the characteristics of transparency and immutability of the data are perfectly suited to the area of guarantees, as they would make the guarantee shown unique and certain, increasing the security of the system and simplifying the verification process. For instance, Interviewee D stated:

“The banking guarantee project is a promising project because it makes the guarantee issued by a certain institution unique and certain”.

And accordingly, Interviewee I claimed:

“Anything to do with processes involving the handling of materiality, i.e. pieces of paper, I consider being very appealing to the application of blockchain”.

In this regard, a project is already underway for the development of a blockchain system through which companies, public administrations and banks can operate to exchange guarantees with each other in a certified and digital manner, which according to Interviewee I should go into production by the end of 2022.

Besides banking and insurance guarantees, interviewees highlighted several banking areas that could benefit from the possible application of blockchain technology and the creation of a common platform to handle transactions such as Know-Your-Customer (interviewee F1), trade finance (interviewees G4 and I), and real estate (interviewee G4).

To conclude, respondents B and H emphasised that blockchain technology and the Spunta experience may also be relevant for the field of CBDCs (central bank digital currencies), but this is outside the scope of the research.

5.5.3 Platform Ecosystem

The common element of all the potentialities presented above is the idea of an ecosystem - the need for coordination between different actors for the management of shared operations - since the great advantage provided by blockchain technology is simplifying the exchange of information between actors through the creation of a trusted environment in which to operate, without the need to delegate decision-making power to a third party. This concept is highlighted in the words of Interviewee F1, who claimed:

“Central to the use of blockchain technology is the concept of an ecosystem. You can do everything without a blockchain, but you need a third party to act as a guarantor, i.e. to guarantee everyone on the exchange of data and so on. Blockchain makes it possible to avoid the need for this third party and to use algorithms to validate [...] So the concept of an ecosystem is fundamental, i.e. it makes sense to think about and seriously consider using a blockchain whenever we are dealing with an ecosystem. Not necessarily what we see can be traced back to an ecosystem, but sometimes, as in the case of the KWC, it might lead us to identify a different ecosystem concept to which we were not accustomed, but which could bring a further positive benefit to the whole system”.

In this regard, a key theme that emerged from the interviews was that the Spunta Banca DLT project went far beyond the objective of reforming a niche back-office process. The ultimate purpose of the project was to build an ecosystem within the Italian banking sector, a common infrastructure on which several projects could be developed and achieve great benefits in the future. For instance, Interviewee I stated:

“The idea that we all had, have and will continue to have in the future with regard to the work carried out in this project is that of having created, or at least we hope to have created, a motorway on which other, even more concrete and valuable, use cases can then be built”.

And accordingly, Interviewee C declared:

“It wasn't so much the Spunta application that let's say was kind of an excuse, but creating the infrastructure underneath, a stable infrastructure to have other use cases on it”.

The respondents did not expect many benefits from the improvement of the Spunta process. According to interviewee G1, a manager at one of the banks, the initiative even became uneconomical as the management of the process became more costly with the new system. However, there is a common understanding that the investment made for this project in terms of time, money, and education of the actors, can bring great benefits in the long run that go far beyond the project itself with the expansion of the use of blockchain on the other areas of the banking system.

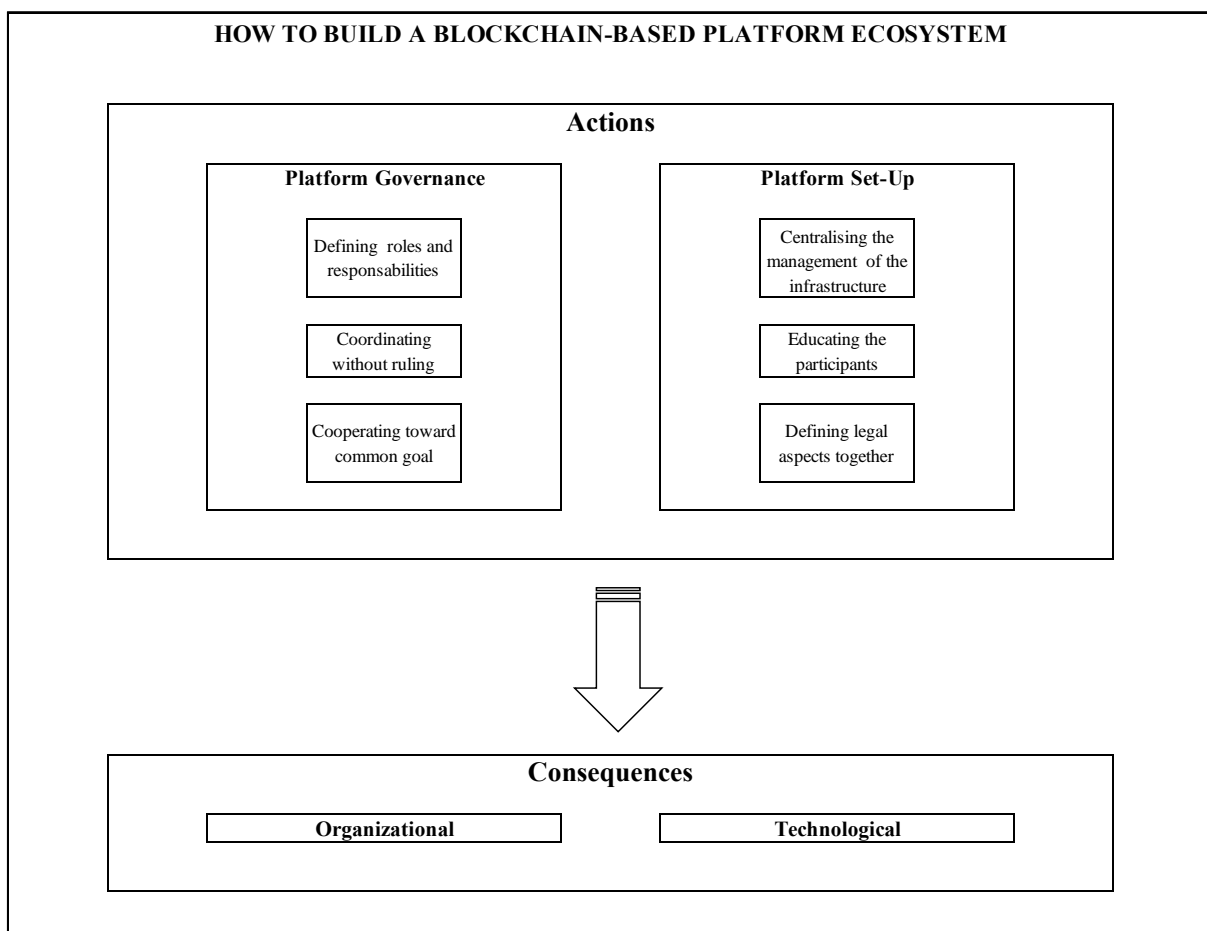
6. DISCUSSION

This chapter hits the research objective by answering the research question through the presentation of a summary model based on the findings that emerged from the analysis of the interviews and their comparison with the concepts highlighted in the literature review.

6.1 How to build a blockchain-based platform ecosystem

The model depicted in Figure 3 below summarises the findings highlighted through the analysis of the interviews. It emphasises the main actions and procedures taken that led to the successful development of the platform and the consequences in terms of the benefits and challenges of adopting the new system.

Figure 3 - How to build a blockchain-based platform ecosystem



Note: Elaborated by the author

Concerning the actions for the successful development of the platform, they were grouped into the two main dimensions highlighted in the finding and in the literature: platform governance - which refers to the set of actions related to the definition of roles, responsibilities and processes within the system and thus influences the operation of the platform and the creation of value within it (Aulkemeier et al, 2019) -; and platform set-up - which concerns the setting of the platform and highlights the conditions and practices that led to the successful implementation of the platform, addressing the issues of the implementation and management of the technological infrastructure (Saheb & Mamaghani, 2021), the training of actors (Spahiu et al., 2021) and regulatory alignment (Herian, 2018).

With respect to the consequences due to the adoption of the new system, the benefits and challenges identified by the analysis were divided according to the distinction proposed by Saheb and Mamaghani (2021) into technological - which refers to the specific technical features of the technology and the benefits or challenges they entail - and organisational - which concerns the internal dynamics within the system caused by the use of the new technology.

6.1.1 Platform Governance

As regards the governance structure, the analysis identified three main factors that characterised the project and contributed to the success of the platform: the definition of a clear governance model, the adoption of decentralised governance, and the strong cooperation between the different actors.

Firstly, the clear definition of the governance model, roles and responsibilities within the system, guarantees the ability to identify precisely and easily the boundaries of accountability. This issue of role clarity seems to address one of the main barriers to the success of inter-organisational platform development highlighted in the literature, namely the cost and the complexity of collaboration between participants (Adner, 2017) as it drastically reduces uncertainty regarding roles and responsibilities and increases alignment between actors.

Secondly, the analysis highlighted how the adoption of a decentralised governance model - where the control power is shared by the community - is a central element for the proper use of blockchain and often this represents a major flaw in projects that implement this technology, since they adopt a traditional centralizing model, losing the benefits offered using blockchain. This is in line with what is stated in the literature, according to which a central feature of

blockchain technology is to enable the creation of a trusted environment without the need for centralised control (Ali et al., 2020), allowing to overcome several barriers related to traditional centralised governance systems such as the need to assign control power to a party and the low level of trust between participants (Catalini & Gans, 2019; Davidson et al, 2018; Kołodziej, 2019), and the costs of intermediation (Ali et al., 2020; Pereira et al., 2019).

Lastly, a key factor for the success of the platform was the strong cooperation between the actors, who demonstrated flexibility, negotiation skills and empathy. Indeed, a potential problem with the decentralised governance model highlighted in the literature is the need for a high level of involvement between parties (Chen et al., 2021; Harris & Wonglimpiyarat, 2019). The main driver of the cohesion was the belief that they could create a system solution that would bring important benefits to the banking sector. This is consistent with the literature analysed, which highlights how companies are shifting towards a more collaborative approach with their competitors within their value chain to improve efficiency, reduce risk and strengthen their competitive position (Adner, 2017; Ritala et al., 2014). This new approach - which combines both collaboration and competition to enhance value creation - is referred to as "co-opetition" (Ritala et al., 2014) and relies on the exploitation of digital technologies (Tan et al., 2022) such as blockchain.

Crucial to the successful functioning of this decentralised governance model has been the role of ABI Lab, which managed the development of the platform and the coordination of the different actors assuming the role of business network governor, but never ruling. This interpretation of the governor role assumed by ABI Lab matches the figure of the "platform orchestrator" found in the literature, who sets up the platform and coordinates the different participants, but it gives up the decisional power to them (Vella & Gastaldi, 2021). ABI Lab has guaranteed equality within the decision-making process, ensuring that everyone's interests are represented through the establishment of democratic systems of decisions such as voting or general meetings. The role assumed by ABI Lab and the decision-making processes adopted are consistent with the best practices highlighted by Constantinides & Barrett (2014) for the proper development and functioning of an inter-organisational structure, such as involving all stakeholders in the development phases and ensuring that everyone's interests are represented.

To conclude, analysing the governance of the project through the model of Spagnoletti et al. (2015), which links the right governance structure to the type of social interaction that the

platform supports, it is possible to highlight how the governance system adopted presents the characteristics indicated as success factors for the development and correct functioning of the digital platform. The social interaction supported by Spunta Banca DLT could be framed as a collective action since the participants in the project belong to the same industry, are subject to the same rules and competitive pressures, and act jointly to achieve a common goal - to create a shared platform for the management of interbank processes. Starting from this, the authors point out two main success factors of a platform which supports a collective action: providing coordination mechanisms for negotiating goals and boosting loyalty among members; and integrating deliberation and voting functionalities in trusted environments to ensure transparency of the collective decision-making process (Spagnoletti et al., 2015). In this regard, the role adopted by ABI Lab - which acts as a facilitator, coordinating and involving all participants - and the governance model adopted - for which the community defines the rules, the roles, the activities, and the distribution of value through democratic systems such as voting and general meetings - fully meet these two requirements and thus allow the platform to be effective guaranteeing horizontal coordination and facilitating communication between participants.

6.1.2 Platform Set-Up

As regards the success factors in the development of the platform, from the findings four main themes emerged: one - the specific features of the interbank reconciliation process in the Italian context – which is strictly related to the project, and the other three – technological integration, education of actors and regulation alignment – that instead could provide for important insights for the literature and similar cases.

Starting from the background conditions that favoured the development of the project, the interbank reconciliation process was selected because it had the ideal conditions to test the technology without incurring excessive risks to the banks' business: it was a back-office process that did not involve the commercial area of competitiveness between banks and the relationship with customers; it was relatively simple and already provided for a shared register between banks; it was a very outdated and cumbersome process that required modernisation; and it was regulated by ABI Lab, the promoter of the project.

At the infrastructural level, the use of blockchain technology required a shift from a centralised type of database - where data are owned and stored in a central structure - to a distributed one

- which means that the database is stored among the network (Pereira et al., 2019). Thus, the distributed nature of the technology requires the ability to parallel management of multiple separate infrastructures through the integration of different systems and the creation of shared infrastructure (Saheb & Mamaghani, 2021; Vella & Gastaldi, 2021). Fundamental to the proper functioning of this type of system is the standardisation of the participants' different systems and ensuring that they all have the same operational capacity. To achieve this, the technology partners developed an integrated service solution for all banks that allowed each to manage its node and run its application, but on a system that was centrally managed at a technological level to guarantee operability. The key strength was to centralising the development and the technical management of the shared infrastructure in a single technology provider, because it made it possible to define a solution that took into account the needs of all parties involved and, at the same time, relieved the banks from having to worry about the integration and operation of the system since they were provided with a turnkey solution and the shared infrastructure is controlled and managed by a single entity.

Another strength in the development of the platform was the test-and-learn approach adopted, which ensured the education of all participants by providing a long and structured testing phase before going into production. All the actors were involved from the outset, hence the adaptation to the technology was gradual and by the time it reached the production phase all participants were familiar with the new system. This made it possible to overcome the challenge highlighted in the literature of the lack of knowledge and understanding of the technology (Saheb & Mamaghani, 2021; Spahiu et al., 2021) which is closely linked to one of the barriers to the success of inter-organisational platforms, namely the capacity of all actors to fulfil their tasks (Adner, 2017).

Lastly, from a legal point of view the success factor in overcoming the several challenges highlighted in the literature – such as governance and accountability, contract enforcement, data protection, privacy, and confidentiality (Herian, 2018; Malhotra et al., 2021; Stasi & Attanasio, 2021) - was the involvement and cooperation of all stakeholders around the legal issue from the early stages of the project through the establishment of a working table between the lawyers of the participants, who discussed and defined all the legal aspects and draw up a contract signed by all the parties regulating the system. Furthermore, in the case of Spunta, the process of regulatory adaptation was straightforward since ABI Lab, the promoter of the project, is also the regulator. However, it is important to underline that for the development of

projects of this kind, it is necessary to have an alignment from a regulatory point of view by the supervisory authority and therefore cooperation between public and private (Herian, 2018; Malhotra et al., 2021; McWaters, 2016).

6.1.3 Technological Consequences

As far as the technological aspect is concerned, from the analysis emerged that the new system ensured a significant gain in efficiency through automation and standardisation of the process, simplifying and speeding up the management of transactions and reducing operational costs. These benefits are in line with the potential benefits highlighted in the literature analysed, which emphasises how blockchain provides operational simplification (Ali et al., 2020; Buchinger et al., 2020; Malhotra et al., 2021; Saheb & Mamaghani, 2021), automatization (McWaters, 2016; Saheb & Mamaghani, 2021), efficiency improvements (Ali et al., 2020; Garg et al., 2021; Harris & Wonglimpiyarat, 2019; McWaters, 2016) and cost efficiencies (Buchinger et al., 2020; Catalini & Gans, 2019; Saheb & Mamaghani, 2021; Seebacher & Schüritz, 2017; Spahiu et al., 2021).

Furthermore, other benefits highlighted in the findings that are not present in the literature analysed include greater timeliness in the management of flows - as the procedure is now handled daily instead of monthly - and a reduction in errors in the matching procedure.

Conversely, regarding the topic of data security and data privacy, the literature points out that one of the benefits of blockchain is an improvement in terms of privacy and security (Ali et al., 2020; Kołodziej, 2019; McWaters, 2016; Pereira et al., 2019). However, this benefit did not emerge during the interviews, probably because Spunta is a back-office operation already previously handled within the banking system so there were no issues regarding data security and privacy. The benefits that can be derived from the adoption of blockchain technology regarding data privacy and security presumably concern more the application of this technology to processes that deal with the public.

On the other hand, the main challenge from a technological point of view concerned the management of a large amount of data on the system, which caused scalability and performance problems and required a great deal of work by the technology partners. The issue of scalability and performance of systems adopting blockchain technology is also prominent in the literature analysed, where several authors point out that they represent two major barriers to the

widespread use of this technology (Ali et al., 2020; Garg et al., 2021; Malhotra et al., 2021, Spahiu et al., 2021).

Secondly, from the analysis emerged as an important challenge the operational inflexibility of the platform, due to the immutability that characterises blockchain, which causes problems if there is a need to change data in the system. In the same fashion, the literature points out that one of the limitations of the technology is inflexibility at the strategic and infrastructural level (Malhotra et al., 2021; Pereira et al., 2019) and thus it exists a trade-off between data security and operational flexibility.

Another consideration concerns the issue of interoperability. In the analysed literature, interoperability is considered among the main challenges for the adoption of blockchain technology (Ali et al., 2020; Garg et al., 2021; Saheb & Mamaghani, 2021). In this regard, it emerged from the interviews that a long-term goal is to enable communication between different blockchain infrastructures, since by now they cannot currently communicate with each other, and this hinders the diffusion of this type of structures.

The economic investment required to develop a system based on blockchain is another barrier that emerged from the interviews since this technology requires very high equipment and set-up costs. The literature as well underlines how the lack of infrastructure and the costs to implement it can be a problem for the development of projects using blockchain (Saheb & Mamaghani, 2021; Spahiu et al., 2021). The solution adopted by many participants of the project was to outsource the infrastructure development to third-party companies that offered to rent the infrastructure and support banks in the creation and management of their nodes.

To conclude, there is a concern in the literature analysed regarding the potential risk of higher costs of coordination and verification of information (Davidson et al., 2016; Garg et al., 2021; Pereira et al., 2019). However, this issue did not emerge from the interviews. Conversely, the respondents emphasised that the new system has simplified the process of investigating the various suspended transactions. Whereas previously the investigation and coordination between banks had to take place using unstructured forms of communication such as phone calls and emails, which then required a subsequent formalisation in the form of reports, now it is possible to deal with the counterpart directly on the application, greatly simplifying and speeding up the process.

6.1.4 Organisational Consequences

As regards the organisational aspect, a key benefit that emerged in the findings concerns the transparency and traceability of information, as the new system allows all participants to have full visibility of matching transactions in real-time. In the new system, everyone can access the platform and monitor the progress of the process at any time. This issue is also prominent in the literature, where several authors emphasize the benefits of blockchain systems in terms of transparency and traceability of information (Kołodziej, 2019; Saheb & Mamaghani, 2021; Spahiu et al., 2021).

Another main benefit highlighted was the adoption of a decentralised system - where there is no single entity that has control power within the platform, rather the power is shared by all participants – which increased the involvement and the collaboration. This topic is related to overcoming one of the major barriers related to the creation of inter-organizational structures, which is the risk of handing over too much power to the intermediary who manages the platform (Catalini & Gans, 2019; Pereira et al., 2019).

The themes of improved transparency and decentralisation of the governance system fit in with the concept of enhanced trust expressed by both the interviewees and the literature (Ali et al., 2020). These two characteristics help to build trust between participants, who are therefore more likely to cooperate (McWaters, 2016; Saheb & Mamaghani, 2021).

Furthermore, the new system has ensured an improvement in the coordination capacity and ease of communication between the different actors through the creation of a shared platform that connects the different participants in real-time. In the same fashion, the literature highlights how the use of inter-organisational platforms facilitates collaboration and communication between participants (Tan et al., 2022).

Lastly, the common platform made it possible to share the investment in exploring this new technology and thus the risks associated with such exploration. This can be seen as a potential incentive to adopt a pioneering attitude towards new technology. In this regard, the literature analysed does not present any references.

Concerning organisational challenges, the main issues that emerged from the analysis are the need to involve all actors - overcoming mistrust and resistance to change towards a new

technology - and to facilitate coordination between them. These two barriers match the evidence from the analysed literature, which highlights as main challenges the need to obtain strong involvement from participants (Chen et al., 2021; Harris & Wonglimpiyarat, 2019), mistrust due to lack of knowledge and understanding of the technology (Garg et al, 2021; Saheb & Mamaghani, 2021; Spahiu et al., 2021) and cost and the complexity of collaboration between the different parties involved (Adner, 2017; Jacobides et al., 2018; Mukhopadhyay & Bouwman, 2019; Yoffie et al., 2019). In this regard, the advocacy and coordination work carried out by ABI Lab has been crucial in overcoming these two challenges.

To conclude, another central issue found in the literature (Ali et al., 2020; McWaters, 2016; Saheb & Mamaghani, 2021) and that emerged from the interviews concerns the need to redefine and align the regulation to the new process. There is a need for regulatory alignment by the supervisory authority and thus for public-private cooperation. However, in the specific case of Spunta Banca DLT, this alignment was very straightforward since the promoter of the project was also the regulator.

6.1.5 Platform Ecosystem

What emerged from the interviews and the literature analysed is that the concepts of blockchain and ecosystem are closely linked since the technology is only applicable, or makes sense to apply, in the context of an ecosystem, i.e. when there is a need for coordination between different actors that are interwoven and move towards a common goal (Aulkemeier et al., 2019; Mukhopadhyay & Bouwman, 2019; Tan et al., 2022).

As highlighted in the literature (Ali et al., 2020) and confirmed by the analysis of the Spunta Banca DLT project, the main benefit obtained from the use of blockchain lies in facilitating cooperation and the exchange of information between different actors through the creation of a secure and trusted environment for all participants, whilst avoiding the need to define a third-party authority who control the system. As was the case in the Spunta project and highlighted in the findings, the creation of shared infrastructure and the distribution of decision-making power among all project participants led to a high level of cooperation and alignment between participants in decision-making, the integration of different systems and procedures, and a strong commitment to the common goal of creating a common infrastructure within the banking system. These specific characteristics make it possible to fulfil the three requirements highlighted in the literature for the success of digital platform ecosystems: tight integration,

alignment between participants, and commitment to long-term common goals (Adner, 2017; Aulkemeier et al., 2019).

To conclude, it is evident how the Spunta Banca DLT Project through the chosen governance model, the coordination roles played by ABI Lab and the technological partners and the practices adopted in the development of the platform was able to achieve the three degrees of legitimacy defined by Constantinides & Barrett (2014) for the proper development and functioning of an inter-organisational structure: representing all interests at stake and find a common ground between them (pragmatic legitimacy); allowing participants to become familiar with the system (cognitive legitimacy) and making participants understand the value of the platform (normative).

7. CONCLUSIONS

This chapter concludes the research by providing a summary of the work done. Moreover, practical and theoretical implications and recommendations for future research are provided.

7.1 Summary of the research

The research aimed to explore the use of blockchain technology for the development of platform ecosystems that enable the coordination and sharing of processes between actors within the same value chain. The driver of this study is the growing interest in this new technology and its use to develop inter-organisational structures considered capable of ensuring important benefits such as system transparency, operational simplification, efficiency improvement, counterparty risk reduction and so on. However, even though there is great enthusiasm for this topic, there are few projects that have been able to reach an operational phase by going beyond the experimental stage since the failure rate is very high. This research contributes to the current debate by empirically exploring the factors that determine success in the development of platform ecosystems using blockchain, and the main benefits and challenges. To achieve this goal, this research analysed the Spunta Banca DLT project, a project started in 2017 that implemented an inter-organisational platform within the Italian banking sector for the management of a back-office operation – the interbank reconciliation process.

Determined the theoretical framework through a narrative literature review, qualitative interviews were conducted with project participants to gain important insights into the platform development process and the use of the technology. From the analysis of the interviews, performed following the thematic analysis procedure, five main dimensions were identified: platform governance, platform set-up, benefits achieved, platform challenges and future development. The first two dimensions provide an answer to the research question concerning how blockchain has been used to build a platform ecosystem within the Italian banking sector. The next two - benefits and challenges of the platform - allow answering the second part of the research question. The last dimension emphasises the potential of the platform and the technology, providing interesting suggestions for future research. To conclude, in the Discussion section, the findings were codified in the model presented in Figure 2 and discussed through the lens of the analysed literature.

7.2 Practical Implications

From the analysis of the success of the Spunta Banca DLT project, it is possible to derive five main takeaways useful for the development of similar projects.

First of all, blockchain technology is only applicable, or makes sense to apply, in the context of an ecosystem, i.e. when there is a need for coordination between different actors that are interwoven and move towards a common goal. Indeed, the main benefit obtained from the use of blockchain lies in facilitating cooperation and the exchange of information between different actors through the creation of a secure and trusted environment for all participants, whilst avoiding the need to define a third-party authority that controls the system.

Secondly, it is important to adopt a decentralised governance model to make the most of the potential of the technology, whilst clearly defining roles and responsibilities and adopting coordination mechanisms to ensure alignment between all parties and the functioning of the system. In this regard, a facilitating element is the presence of an entity that acts as a facilitator between the parties - the platform orchestrator -, who sets up the platform and coordinates the different participants, but it gives up the decisional power to them.

Thirdly, due to the distributed nature of the technology, a blockchain-based platform requires the integration of the different systems of the participants and the creation of shared infrastructure, ensuring that all the actors have the same operational capacity. A potential solution is to centralise the development and technical management of the shared infrastructure in a single technology provider, which defines a system that takes into account the needs of all parties and ensures the operational capability of the platform without the participants having to worry about it.

Fourthly, since blockchain is a frontier technology, it is important to provide education for all actors involved in the project, so that everyone can use the technology easily and consciously to fulfil their tasks. Involving all actors from the initial testing phases can help them to know and understand the technology in a gradual and guided way.

Lastly, from a legal point of view, the use of blockchain can raise the need to assess various issues such as governance and accountability, contract enforcement, data protection, privacy, and confidentiality. For this reason, the discussion and definition of these legal aspects among

the participants in the project are important. In addition, if the platform operates in a regulated sector such as banking, an adaptation from a regulatory point of view and thus the involvement and alignment of the supervisory authority is crucial.

7.3 Theoretical Implications

This research supports the existing literature on the use of blockchain for the creation of inter-organisational structures. Since the research is based on a single case study, generalising the results obtained on a theoretical level is difficult. However, it is possible to make considerations regarding the comparison between the concepts highlighted in the literature and the empirical evidence that emerged from the case analysis.

Firstly, the case of Spunta verified the centrality highlighted in the literature of the governance model for the proper development and functioning of an inter-organisational platform. In particular, the adoption of a decentralised model allows overcoming the barriers associated with the traditional decentralised structure such as the need to assign control power to a party and the low level of trust between participants (Catalini & Gans, 2019; Davidson et al, 2018; Kołodziej, 2019), and the costs of intermediation (Ali et al., 2020; Pereira et al., 2019). Furthermore, the findings showed that the successful functioning of a decentralised governance model requires the provision of coordination mechanisms for defining roles and responsibilities, negotiating goals, ensuring that everyone's interests are represented and boosting loyalty among members. This is in line with what is presented in the literature (Constantinides & Barrett, 2014; Spagnoletti et al., 2015; Vella & Gastaldi, 2021).

From an infrastructural point of view, the analysis confirmed how the adoption of a blockchain system requires a process of standardisation of the operational capabilities of different actors and the ability to parallel management of multiple separate infrastructures through the integration of different systems and the creation of shared infrastructure (Saheb & Mamaghani, 2021; Vella & Gastaldi, 2021).

Furthermore, another central theme in the literature confirmed by the findings concerns the need to educate actors in the use of the new technology to overcome the barriers of lack of knowledge and understanding of the technology (Saheb & Mamaghani, 2021; Spahiu et al., 2021) and the capacity of all actors to fulfil their tasks (Adner, 2017).

Concerning the benefits that emerged in the findings, all the main technological and organisational benefits highlighted in the literature were also found in the Spunta project. In addition, other benefits evidenced through the analysis that are not present in the literature analysed include: on the technological side, greater timeliness in the management of flows - as the procedure is now handled daily instead of monthly - and a reduction in errors in the matching procedure; while on the organisational side, sharing the investment in exploring the new technology and the risks associated with such exploration through the development of a common platform.

As regards the challenges, once again the findings confirmed the main challenges highlighted in the literature, except for the potential risk of higher costs of coordination and verification of information (Davidson et al., 2016; Garg et al., 2021; Pereira et al., 2019) which does not emerge during the interviews. Conversely, the respondents emphasised that the new system has simplified the process of coordination and investigation. The analysis did not reveal any additional challenges to those found in the literature.

To conclude, the analysis conducted showed how the use of blockchain is closely linked to the presence of an ecosystem since the main benefit obtained from the use of blockchain lies in facilitating cooperation and the exchange of information between different actors through the creation of a secure and trusted environment for all participants, whilst avoiding the need to define a third-party authority who control the system (Ali et al., 2020).

7.4 Future Research

This research can be the foundation for future research on the use of blockchain for the development of inter-organisational platforms.

Starting from the delimitations defined at the beginning of the research (section 1.4), this study is based on the analysis of a single case study and therefore the generalisability of the conclusions is limited. In addition, the second limitation concerns the specific geographical and regulatory context in which the use case is developed. In this regard, once the number of projects of this type that reach an operational phase grows, a comparative study, as a multiple case study, could provide more generalisable results, examining several similar projects developed in different contexts and comparing their characteristics and results to identify points of convergence and divergence.

Moving on, as discussed in section 5.5, the Spunta Banca DLT project itself still has potential for development, both regarding a geographical extension and an operational extension - with improvements from a technological point of view and new use cases applied to the infrastructure created. In this respect, future research could investigate the developments of the project and draw new and different conclusions based on the results achieved.

As regards technological improvements, it would be very interesting to assess through future research the effects on the platform once the archiving of old data mechanism has been applied. This mechanism could bring huge benefits in terms of data management and scalability of the platform, providing useful hints for applying the solution to other platforms.

To conclude, concerning the development of new use cases on the common infrastructure created, future research could evaluate the new benefits and challenges faced when applying the technology to the management of processes that deal with the bank's business and the relationships with customers as in the case of the project on banking and insurance guarantees, the most likely at the moment, but also to other areas of possible application that emerged during the interviews such as know-your-customer, trade finance and real estate.

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APPENDIX

A - Blockchain and Distributed Ledger Technology (DLT)

Blockchain systems are part of the broader category of distributed ledger systems. Distributed Ledger Technology (DLT) is a protocol that allows the creation and functioning of decentralised digital databases. It uses cryptography to store information which can only be accessed through specific keys and cryptographic signatures (Frankenfield et al., 2021).

Blockchain is a way to implement a distributed ledger, which is characterised by a shared and replicated register of data collected in groups called 'blocks' and verifies transactions automatically if certain conditions are met by adding a new block to the chain visible to all network participants. However, not all distributed ledgers necessarily employ blockchains. Distributed Ledgers may present different data storage and validation systems. For instance, in some distributed ledgers, not all nodes need to receive the information. The Corda system implemented in the Spunta Banca DLT project envisages that only the nodes involved in the transaction are aware of the transaction itself (Rutland, 2017).

Distributed ledger systems can be either public or private systems: in public systems, anyone can carry out transactions on the network, whereas in private systems only identified actors with the right to participate can take part in the network (Garg et al., 2021; Stasi & Attanasio, 2021). A centralised distributed ledger is more suitable in the context of inter-organisational platforms within regulated industries - such as financial services - because it minimises vulnerability and allows transactions to be audited as the actors are known (Rutland, 2017)

Due to its specific characteristics, the blockchain is a suitable system for public systems since it allows the global broadcast of transactions and a fully automated and decentralised validation system (Proof-of-Work). However, in private systems such as Spunta Banca DLT, the blockchain model is not optimal because there is no need for such a complex and resource-intensive validation system since the network is private and controlled. In addition, the blockchain system poses risks from a security point of view because it could allow actors within the network with strong computing power (a good number of nodes) to add fraudulent blocks (Rutland, 2017).

Once this distinction is emphasised, however, it must be explained how the two terms - blockchain and distributed ledger - are often used interchangeably. In particular, as blockchain has now become a catch-all term, it is often used to refer to distributed ledger systems, and this is also the case in the literature analysed. The promoters of the Spunta project themselves refer to it as blockchain/DLT:

“This sector has successfully pioneered the use of blockchain/DLT with a new application, Spunta Banca DLT, for straight-through processing of interbank reconciliation” (Stasi & Attanasio, 2021, p. 313).

For this reason, in this research, the more popular term “blockchain” is used, albeit technically incorrect, as an umbrella term to refer also to distributed ledger systems.

B – Interviews’ details

INTERVIEWS				
Interview	Governance Level	Role	Date (YY/MM/DD)	Location
A	Business Network Governor (BNG)	Research Analyst	2022-03-25	Online - Microsoft Teams
B	Business Network Designer (BND)	Head of Blockchain Service Line	2022-04-04	Online - Microsoft Teams
C	Business Network Operator (BNO)/ DLT Network Provider (DNP)	Head of Connectivity Services	2022-03-15	Online - Microsoft Teams
D	Business Network	Head of Operations	2022-03-11	Online - Microsoft Teams
E	Business Network	Operations specialist (1); Accountant (2)	2022-03-18	Online - Microsoft Teams
F	Business Network	Head of Process Innovation (1); IT Functional Analyst (2); IT Specialist (3)	2022-03-29	Online - Microsoft Teams
G	Business Network	Head of Interbank Settlement Service (1); Operations Specialist (2); Head of Demand and Project Portfolio Management (3); Demand and Project Portfolio Manager (4)	2022-03-31	Online - Microsoft Teams
H	Business Network	Innovation Specialist (1); Operations Specialist (2)	2022-04-05	Online - Microsoft Teams
I	Business Network	Senior Demand Manager - Innovation, Payment & Global Transaction Banking	2022-04-11	Online - Microsoft Teams
J	Business Network	Operations Specialist (1); Institutional Banking Specialist (2)	2022-04-13	Online - Microsoft Teams

Note: Elaborated by the author

C – Data analysis

Empirical Themes	Conceptual Categories	Aggregate Dimensions	
Both managerial and operational levels of banks were involved in the decisions	Roles and Responsibilities	Platform Governance	
Engaging all the stakeholders and treating them equally			
Clear division of roles and responsibilities			
Platform governor as a facilitator	Decentralization		
Blockchain eliminates the need for a unique controller to govern the platform			
There must be the willingness to decentralize			
Blockchain/DLT requires an ecosystem	Cooperation		
Great involvement and collaboration between banks			
Banks had to be flexible to reach a common goal			
Exploring and testing cutting-edge technology	Case Drivers	Platform Set-Up	
Applying in a back-office process without business risk			
Digitalising and optimising an old process			
Established development phases of the project	Test and Learn		
Learning how to use the platform through test phase			
Gradual implementation of the new system			
Standardising processes and operational capacities of the participants	Integration		
Providing an integrated solution			
Modularity and autonomy about local infrastructure (local)			
Defining clear rules and being able to comply with them	Regulation		
Single contract agreed between all participants			
Adapting regulation to the new system			
Automatize and symplifying the process	Technological Benefits		Platform Benefits
Increased efficiency			
Increased timeliness			
Error reduction			
Increased transparency and traceability	Organizational Benefits		
Easier communication and coordination			
Decentralization			
Sharing the investment and the risks associated			
Dealing with huge volume of transactions	Technological Challenges	Platform Challenges	
Trade-off between capacity and performance			
Immutability can be a problem			
Interoperability issue			
Expensive technological infrastructure	Organizational Challenges		
Reluctance to use a new technology			
Coordinating multiple actors with different needs			
The need to align the regulatory framework			
Extending the system to foreign banking systems	Geographical Expansion	Beyond Spunta	
Other solutions already exist abroad			
Enabling the archiving of old data	Operational Expansion		
Using blockchain for banking and insurance guarantees			
Extending the use of blockchain to other business functions			
Building a shared infrastructure within banking sector for future applications	Platform Ecosystem		

Note: Elaborated by the author

D - Exemplary quotations of conceptual categories

Aggregate Dimensions	Conceptual Categories	Representative quotations
Platform Governance	Roles and Responsibilities	<i>One of the success factors was the clear allocation of roles - NTT data was given the role of developing the application, SIA/Nexi was given the role of managing the technological infrastructure and ABI Lab acted as coordinator of these roles, which were then established in a contract signed by all the banks</i>
	Decentralization	<i>One of the issues that is often underlined as a weakness in DLT projects is the topic of governance, because there is a risk of doing things in DLT, therefore of doing something distributed, with a centralised governance, which is a bit of a contradiction. In this sense, the role of Abi Lab as a facilitator and not as a governor in the strict sense of the word was certainly an important element because decisions are taken by the network.</i>
	Cooperation	<i>There has been involvement from the outset. The banks have always shown great cooperation in this respect and this has been one of the great successes of the project.</i>
Platform Set-Up	Case Drivers	<i>It was considered an excellent process to begin for a number of reasons: it does not have a direct impact on the customers, ... it is a niche process, it is relatively simple ... and since it is based on shared registers between two banks, it was very well suited to the concept of DLT.</i>
	Test and Learn	<i>Let's say that we were trained during the test phase - we tried to do the various operations of analysis, sending suspensions, matching for operations that could be matched by hand - so the adaptation was easy because when the system went into production phase the functions were already known and could be accessed.</i>
	Integration	<i>Now, to my knowledge, everyone has eliminated their own proprietary application and it has been possible to bring to this Spunta application all the prerogatives and particularities that everyone had put into their own application. The Spunta system, therefore, is the result of all the applications of the different banks and is a very solid application.</i>
	Regulation	<i>the Spunta is a process regulated by ABI so this was an element of simplification because it was easy to modify the regulation ... a single service contract was established to which the individual banks adhered, defining the regulation of the functioning and governance of the system</i>
Platform Benefits	Technological Benefits	<i>We benefit from the new system, our big benefits are the speed and the automation of the procedure... it simplified and optimised a procedure that was very old</i>
	Organizational Benefits	<i>Another critical factor is the communication and investigation exchanges that take place between the users of the correspondent banks... through Spunta Banca DLT it becomes much easier to coordinate and deal with the counterpart</i>
Platform Challenges	Technological Challenges	<i>The application still has very big operational constraints in terms of performance, capacity, distribution... the application had some pretty major performance problems that we really had to devote a lot of time and resources to stabilise and get the platform in a condition to be able to launch.</i>
	Organizational Challenges	<i>If I had to tell you what were the elements that hindered the project a bit, on the one hand breaking the wall of starting to use a new technology... on the other hand acting on people who are used to working in a certain way and tomorrow will have to do it in another, a priori change always generates resistance.</i>
Beyond Spunta	Geographical Expansion	<i>Extending the Spunta application to foreign banks would be very important because it would give a uniformity of process that would allow us to achieve absolute efficiency. It is an improvement approach that I see very well, it seems to me to be the natural completion of the project.</i>
	Operational Expansion	<i>The process is still developing and perfecting, it is not yet finished, there are still a whole series of activities that are being studied such as data archiving... account closure... In addition, this technology will give the possibility to open new fronts in different areas... trade finance... bank guarantees... KYC... Real estate</i>
	Platform Ecosystem	<i>The idea that we all had, have and will continue to have in the future with regard to the work carried out in this project is that of having created, or at least we hope to have created, a motorway on which other, even more concrete and valuable, use cases can then be built.</i>

Note: Elaborated by the author