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Blockchain in Banking: A Critical Review of the Financial Ecosystem and Possibilities. A European Economy Perspective.

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Abstract

The integration of blockchain technology into the banking industry marks a watershed moment in the financial ecosystem, with the potential to disrupt established banking structures, improve operational efficiency, and increase transparency. This paper examines blockchain applications in the European banking sector, focussing on how this decentralised technology affects financial institutions, regulatory frameworks, and client interactions. Incorporating case studies and actual data, the paper investigates the influence of blockchain on core banking processes as payments, clearing, settlement, and Know Your Customer (KYC) procedures. It also looks at blockchain's potential to improve cybersecurity, decrease fraud, and minimise operating costs, all while addressing scalability, regulatory compliance, and acceptance problems in the European financial sector.

This paper critically evaluates how European banks are positioning themselves in this rapidly evolving space, weighing both the opportunities presented by blockchain such as real-time cross-border transactions and streamlined compliance processes and the potential risks, which include data privacy concerns and regulatory hurdles. A comparative review of worldwide banking systems reveals the European economy's distinct prospects and limitations in implementing blockchain. The paper concludes by providing insights into blockchain's future possibilities in shaping a more resilient, transparent, and inclusive banking system in Europe, as well as recommendations for policymakers and financial institutions seeking to leverage blockchain technology while mitigating associated risks.

Keywords: Banks, Blockchain, Clearing houses, Cryptocurrency, Financial Institutions, Financial regulations, Financial technology, Security regulation, Stablecoins.

I. Introduction

Expectations about blockchain's applications were high when interest in it started to pick up speed a few years ago. Blockchain was hailed as the technology that will improve our democracy, healthcare system, and supply networks. However, industry interest in blockchain use cases declined after trials of possible blockchain applications, such as pilot projects run in the banking and financial services sector, failed to live up to the hype. Some interested in blockchain technology discovered that, in some situations, more affordable traditional centralised databases might offer the same features as blockchain.

Since commodity banks, the banking industry has undergone significant change, and contemporary financial institutions are continuously adjusting to the most difficult circumstances. Prior to the invention of money, banking was done through the exchange of necessities like grain. Grain banks were used in the past by farmers to store grain and periodically remove it to guarantee a consistent food supply while their next harvest was being harvested. Managing all of the grain, food, and livestock in a commodity-based banking system was a real difficulty (Owoeye 2023)

According to Owoeye (2023) around 700 BC, the Lydians became the first society in the Western Hemisphere to mint metal coins for use as currency. Paper money was introduced by the Chinese in the tenth century. During the American Revolution, British economist Adam Smith promoted a laissez-faire policy, which brought the market-centric approach back to banking.

The digital revolution in the banking sector offered opportunities to further economic development and enhance the business model. It still seems new, given that the fourth industrial revolution is only getting started. The term "digital transformation" describes the continuous adjustments that digital technology brings about in society and business, enhancing consumer experiences and corporate operations while also generating new business models (Owoeye, 2023).

But given the recent change in the European government's stance on blockchain and cryptoassets, this is a good time for the continent's financial sector to take another look at this more advanced technology and explore how blockchain can be used to both enhance currently available goods and services and provide brand-new, more affordable options. Public and private blockchains may be used in a wide range of financial use cases, creating new markets for banking services that are advantageous to banks and clients alike by enabling quicker, less expensive, more secure, and more inclusive transactions.

The European governments have an edge in terms of resources available to create blockchain solutions and lead the early deployment of blockchain-based products in the financial services industry because of their big talent pool and innovative culture. Blockchain technology has the potential to significantly improve the global financial system, but only if it receives backing from both the commercial and regulatory sectors. In order to maintain the United States' lead in cryptoasset innovation, regulatory action is needed as new foreign competition surfaces, with China advancing its digital yuan. The US can reaffirm its leadership in blockchain development for the financial services sector by working together in the public and commercial sectors to advance a technologically advanced regulatory framework.

Furthermore, the whole financial services industry ought to benefit from this next-generation technology through cooperation between regulators and financial services businesses as well as the creation of standardised solutions. By using both public and private blockchains to standardise industry solutions, transaction friction can be eliminated, manpower costs and back-end expenses may be drastically decreased, and transaction speed and security can be significantly increased. As a result, the financial services sector will be able to broaden the range of products and services it offers, establish new revenue streams, and reach out to previously untapped markets.

The prospective uses of blockchain technology that we believe will have the most impact on the banking sector are separated into sections of this study. These include blockchain-based lending, clearing and settlement systems, and currency. We distinguish between possible applications for decentralised, public, permissionless blockchains (like cryptoassets) and private, permissioned blockchains under the control of one or more parties for each application. This study aims to analyse where the potential lies and what legal problems need to be answered in this new, exciting, but unclear legal world.

This research will intend to answer the following questions

1. What are the potential applications of blockchain are consider most significant to the banking industry
2. What are the legal perspectives of blockchain in the European Banking Industry.

The paper is organised as follows: Section 2 discussed the research methodology. Section 3 provides the theoretical approach. Section 4 presents the literature assessment to answer the study questions. Section 5 presents the critical comments, while Section 6 presents the paper's conclusion.

Research Methodology

This study employed a systematic literature review (SLR). This finds, selects, and assesses research to provide a response to a specific question. The systematic review should follow an established approach or plan with well-defined criteria before beginning the review.
For every study subject that was provided, the author employed SLR to compile a summary of the most important literature sources. An SLR was carried out by the authors with a sample of 120 research papers. These articles were selected from a collection of 500 papers that were gathered from Scopus, Web of Science, and Google Scholar. The publications were

chosen based on the number of citations found in Google Scholar and Scopus, as well as the journals' impact factor in Scopus.

In addition, the author addressed each research topic and synthesised the literature using the QCA. Since most academic research on blockchain has been conducted within the last ten years, and since blockchain is a relatively young industry, the author chose to focus on the most recent articles—those published between 2001 and 2024—that received a lot of scholarly attention. The SLR is a systematic, clear, comprehensive, and repeatable procedure for finding, assessing, and synthesising recent research, scholarly works, and practice literature, claim Okoli and Schabram (2010). The three main steps of the SLR process are review planning, review execution, and review reporting. Formulating the review and developing and verifying the review method are the two phases that make up the review planning process. The next five parts of the review process include locating the relevant literature, selecting it for inclusion, grading its quality, gathering data, and analysing and synthesising the findings. The review is finally reported on, providing an overview of the findings (Xiao & Watson, 2019).

QCA, or qualitative comparative analysis, is a method for identifying the contributing elements to certain outcomes. This is a research strategy for deriving relevant findings from context-based data to provide understanding, novel concepts, and fact interpretation together with a useful application guide. The objective is to portray an all-encompassing and all-encompassing image of the phenomenon. Generally speaking, a model, conceptual map, conceptual system, or categories are created using the concepts or categories found in QCA.

QCA is approached from two different angles: deductive and inductive. Inductive reasoning is used when there is not enough previous knowledge in the field. However, when doing new analysis based on existing data or when conducting hypothesis testing is necessary, deductive content analysis is utilised (Elo & Kyngäs, 2008). The author utilised the inductive approach to critically examine the study. There were three phases to the process. In order to start, the author chose articles from search publications that answered the three study questions. Next, the author determined which phrases from each section addressed the research questions of the study.

This paper will evaluate the critical questions highlighted above. The next section will provide a detailed discussion of the theoretical perspectives of Blockchain in the Banking Industry.

Theoretical Perspectives

The aim of this study is to examine the impact of innovative technology integration, particularly blockchain technology, on the banking industry. Testing the proposed conceptual research model using disruptive technologies currently under consideration in the study of Blockchain towards qualitative service delivery through employee performance in the Banking industry based on service differentiation was made possible by the proposed disruptive technological theory (Christensen, 1997) and the business model with radical innovation (Markides, 2006).

The creative technology integration approach suggests that banks should use disruptive technologies to create new and efficient products, processes, or services that will enhance service delivery. Christensen defines disruptive innovation as a process where a product or service is used to alter the economics of a company by making it more accessible and affordable. As a result, the company is brutally propelled forward in its industry.

Christensen states that a disruptive invention that is effective should have the following qualities: Firstly, a technology that facilitates. This innovation should make the company's goods and services more accessible to a wider demographic. Secondly, a unique business plan. The company plan should target low-end or non-consumer clients (i.e., new customers who have never purchased goods or services in a particular market; they are the least lucrative customers). Coherent value network comes in third. He emphasised how crucial disruptive innovation is to all parties involved. In this instance, new alternatives for distributors, suppliers, partners, and customers should be produced via disruptive technologies that arise from financial advances.

The idea of hybrids—self-sustaining creations that combine cutting-edge and disruptive technologies—is developed in this paper. This paper argues that banks in the financial sector should adopt financial innovations, especially when they are in the hybrid stage of a disruptive revolution, based on the application of this idea. A hybrid technology is a novel and innovative combination of old and modern technologies that, when compared to the old technology, represents a sustaining innovation.

Five sets of service differential variables—security, quality management, operations, strategic solutions, and technology—are explained by the proposed model. These variables all encourage the adoption and use of disruptive technologies, like blockchain, to enhance employee performance and provide high-quality services to the European banks.

Extensive Literature Review

As a broadly applicable basis, Christensen (1997) constructed his core theory, which primarily focused on the impact of disruptive technology on organisations and across industries. The same general rule based on his theory could not be used throughout time since new inventions have varied effects on the company as technology develops and the business environment shifts. In his work, Markides (2006) focusses on product innovations and business models. He said that business innovations are different from technological discoveries when pondering how an established firm should embrace them when identifying a new business model from an old one.

The present iteration of this technical advancement has successfully completed many hopeful cycles of upgrading for improved product supply. Traditional banks provided and explored technological innovations in online banking as a means of managing strategically online, and this had a greater impact on the environmental and strategic choices made by bank managers (Callaway and Hamilton, 2008). In recent years, a large number of writers have significantly written on advanced blockchain and artificial intelligence. However, it has lately seen a significant revival due to a number of new technologies that draw inspiration from natural intelligence and aim to improve the effectiveness and efficiency of the systems in handling complex tasks (Oh and Shong, 2017).

Financial innovations are at the heart of the banking industry, bringing about goods and services utilising financial technology to differentiate the various banks' offers, according to the several models that have been shown above (Dewasiri et al., 2023).

The use of blockchain technology in the banking sector was the focus of the following section.

Blockchain

Artificial Intelligence is not as beneficial as blockchain, another Fintech branch, in providing high-standard financial services. It alludes to a decentralised digital ledger where every activity and transaction is publicly and chronologically recorded in a manner that is impossible for one person to manage or accomplish alone. Currently, 25% of all international remittances are made possible by blockchain technology (Flore 2018). Given its ability to induce a change in business paradigms, it undoubtedly represents a substantial part of digital transformation. By utilising the huge potential of its fundamental concepts, it is revolutionising a number of conventional banking practises. These ideas are described here to help you better understand the blockchain concept.

Blockchain's decentralised, transparent, and secure characteristics are what give it its value. A business's database should always be secure, impenetrable, transparent, and indestructible. Furthermore, blockchain perfectly solves every issue that conventional database systems run into.
Moreover, blockchain significantly reduces operating costs by doing away with the need for middlemen. Additionally, transaction speeds have increased due to blockchain's quickness. These unique qualities have not only made blockchain highly relevant but also an efficient and cost-effective option for all businesses (Au and Kauffman, 2008).

The next section will provide robust discussions on the applications of Blockchain in the Banking Industry.

Applications of Blockchain in the Banking Industry.

1. **Blockchain-Based Currency**

Portilla et al (2022) and Owoeye (2023) argued that Blockchain technology is rapidly transforming the way assets are exchanged, held, and tracked. Individuals, businesses, and even nations are creating and using public and private blockchain-based currencies. These advancements herald the beginnings of a whole new financial industry, as well as the associated entrepreneurial potential. As the market capitalisation and institutional support for cryptoassets rise, banks that build the infrastructure for cryptoasset banking services (such as custody, payment processing, and lending) will be well positioned to serve customers in this new and exciting asset class.

Portilla et al (2022) further opined that as more individuals and companies enter the cryptoasset market, the capacity to deliver cryptoasset-related services will become increasingly important. The inherent complexity and novelty of storing cryptoassets is expected to increase demand in having a trusted intermediary provide custody services. Aside from just preserving these assets, when other types of cryptoassets emerge, banks and regulators should be prepared to offer further cryptoasset-based financial solutions.

2. **Decentralized Cryptoassets**

Bitcoin is rapidly emerging as a new store-of-value asset, comparable to real estate or gold, because to its distinct monetary qualities, which include built-in durability, scarcity, fungibility, mobility, and divisibility. Bitcoin has been gaining popularity among private investors for years. Corporations have recently begun to integrate Bitcoin to their balance sheets, with some believing that Bitcoin will help safeguard shareholder value from the consequences of global aggressive monetary policy (Portilla et al, 2022 and Owoeye 2023)

Reback (2021) argued that one of the first significant corporations to invest in Bitcoin and is often regarded as the most active corporate buyer of the cryptocurrency. After changing major chunks of its cash treasury into Bitcoin in the summer of 2024, and a following series of debt offerings to buy more Bitcoin, MicroStrategy currently has around 226,500 Bitcoins on its balance sheet as at August 1, 2024 (Bitcoin Treasuries)

Technology companies like Square and Tesla have followed suit. Square, a mobile payments business established by Jack Dorsey, purchased $50 million of Bitcoin in 2020 and an additional $170 million of Bitcoin in 2021(Chong 2020).
According to on-chain intelligence platform Arkham, Hope (2024) argued that blockchain investigators claim to have discovered the Bitcoin wallets of Elon Musk's enterprises, Tesla and SpaceX, which disclose a combined balance of more than $1 billion. According to their investigation, Tesla's wallets have about $771 million in Bitcoin, while SpaceX accounts contain roughly $555 million in BTC. The research looks deeper into the firms' Bitcoin transaction history from early 2021. Notably, during the May 2022 crypto meltdown, both Tesla and SpaceX sold off a large chunk of their Bitcoin holdings when prices fell. While SpaceX's sales resulted in a net loss, Tesla broke even.

Hope (2024) emphasized that SpaceX's Bitcoin stake restored by November 2023, which coincided with the current Bitcoin bull run. Since then, the price of Bitcoin has roughly quadrupled, pushing SpaceX to a current profit of $132 million on its BTC holdings, according to Arkham estimates. Tesla, on the other hand, has $455 million in Bitcoin profits.

Tesla, on the other hand, has a $455 million Bitcoin profit. These findings, if confirmed, indicate that Tesla and SpaceX's Bitcoin investments were previously underestimated. Previously, experts estimated Tesla's holdings to be approximately 9,720 BTC, while SpaceX's position was unclear. According to Arkham's study, Tesla possesses a bigger sum of 11,509 BTC.

Portilla et al (2022) argued that this one-of-a-kind use case may drive demand for a completely new set of financial services akin to those available for traditional currencies. Holders of Bitcoin and other cryptoassets may request crypto-based financial services such as tailored exposure products, custody and trading solutions, credit lines, Bitcoin prime broking

services, compliance solutions, and more. As a starting point, banks might provide basic derivatives like cryptoasset swaps. These products might capitalise on banks' institutional status as a trusted counterparty while also allowing clients to have exposure to cryptoassets of this nature. Banks might even take direct control of their clients' cryptocurrency assets. Mainstream industrial firms have already entered the space.

3. Centralized Cryptoassets

Portilla et al (2022) further argued that in addition to the services that commercial banks can provide for decentralised cryptoassets, banks can also provide similar services for centralised, blockchain-based cryptoassets or currency-like instruments, such as stablecoins and central bank digital currencies (CBDCs). Stablecoins are cryptoassets that have their value linked to an external reference asset, such as a fiat currency. These new versions of conventional currencies are gaining significance and legitimacy, with the two most prominent stablecoins, Tether and USD Coin (both tied to the US dollar), recently exceeding $50 billion and $25 billion in market capitalisation, respectively (Crawley 2021).

Stablecoins are frequently regarded as a less dangerous option to other cryptoassets due to their emphasis on price stability. While stablecoins provide the benefits of blockchain technology, such as speedier settlement and programmability, they are frequently centralised, with the issuing business keeping authority over the ledger and the ability to supervise and cancel transactions. Stablecoins, like decentralised cryptoassets, provide prospects for financial organisations that develop the necessary infrastructure to provide a variety of banking services.

A critical review of the report of the President's Working Group on Financial Markets (PWG), the Federal Deposit Insurance Corporation (FDIC) and the Office of the Comptroller of the Currency (OCC) in 2021 where it was recommended that stablecoins focus on the arrangement that peg to a fiat-currency. The report argued that the Unites States Congress which is the legislative arm of the United States Government should focus on the legislation on stablecoin issuers. They emphasized regular legislation that requires stablecoin issuers to be insured depository institutions and grants federal agencies extensive regulatory power over custodial wallet providers and other important players in stablecoin arrangements. In the absence of congressional action, the study suggested that the Financial Stability Oversight Council (the FSOC) use its jurisdiction to identify certain stablecoin transactions as systemically significant payment, clearing, and settlement (PCS) operations. This was emphasized in Portilla et al (2022) and Owoeye (2023).

CBDCs are another emerging trend, with central banks researching and piloting their own digital currencies. CBDCs are digital payment instruments issued by a country's central bank, similar to real money but in digital format. According to a January 2020 report by the Bank for International Settlements, of 66 central banks surveyed, 80% responded that they were engaged in some kind of work with CBDCs, with 40% stating that they have progressed from conceptual research to actual proofs-of-concept and experimentation (Boar et al 2020).

According to PwC's CBDC global index for 2021, more than 88% of existing CBDC projects use blockchain as the underlying technology.

Wilson and Jones (2021) suggested that China has lately taken the lead in encouraging the global growth of CBDCs by establishing a global set of standards to manage information flows between central banks and facilitate interoperability among CBDCs from various countries. International interoperability and standardisation may improve the opportunity for institutions who maintain the infrastructure required to manage these cryptoassets.

It is unclear how the fast growth of CBDCs will influence the present structure of the financial sector. In a chapter of its Annual Economic Report 2021, the Bank for International Settlements (BIS) emphasised the necessity of private sector participation in a retail CBDC architecture and provided various models for such architectures (Bank for International Settlements, 2021).

In a single-tiered direct CBDC design, the central bank would manage the whole system, including all operational and consumer-facing responsibilities like account management and customer care. In a hybrid or intermediated CBDC architecture, the system would remain two-tiered, with the private sector handling operational and consumer-facing functions. The central bank's records allow us to distinguish between these two-tiered designs. In the hybrid model, the central bank records retail balances as a backup for the payment system, whereas in the intermediated model, the central bank solely records wholesale balances of particular payment service providers. The People's Bank of China is testing the two-tiered hybrid CBDC architectural system (Bank for International Settlements, 2021). The BIS has supported the two-tier system, stating that the single-tier system may undermine the central bank's function as a relatively lean and focused public institution at the helm of economic policy.

Bitcoins and Legal Perspectives

While new regulatory advice has offered insight and opportunities for financial institutions seeking to provide cryptoasset services, there is still substantial regulatory ambiguity. Owoeye (2023) argued that Financial institutions must endeavour to maintain compliance with a quickly changing regulatory context, as well as develop the infrastructure required to handle public and private blockchain-based assets, services, and activities.

In 2021, the Office of the Comptroller of the Currency (OCC) emphasised that loose regulation will signal support for the expansion of banking services relating to cryproassets and stablecoins by issuing guidance allowing national banks and federal savings associations to provide custody services for cryptoassets, including the safekeeping of cryptographic keys determining that banks that otherwise comply with applicable laws and regulations and conduct adequate due diligence (Ligon 2021)

In 2020, the Securities and Exchange Commission (SEC) issued a statement encouraging stablecoin issuers to work with the agency to structure token offerings in order to ensure compliance with federal securities laws, and noting that SEC is willing to provide confirmation on an ad hoc basis that it will not take enforcement action against specific market participants in relation to specific digital tokens. The SEC's holding Rule, which imposes extra requirements for the holding of cryptoassets that are considered securities (Investment Advisors Act of 1940), is one example of relevant federal securities law laws. One such requirement is yearly independent audits, which may be burdensome for custodians who are hesitant to disclose confidential cryptographic keys to external parties.

The Basel Committee on Banking Supervision (BCBS) recently issued a public consultation paper providing a proposed framework for prudential treatment of a bank’s cryptoasset exposure. In this framework, a categorization of cryptoassets were made into 2. The first category is based on different risk-based capital requirement. This consist of tokenized traditional assets and stablecoins. Both of the assets according the Basel Committee of Banking Supervision (BCBS) argued that would be subject to capital requirements based on the risk weight associated with the appropriate class of traditional assets underpinning the cryptoasset as specified in the present BCBS framework, plus consideration for new technology-related risks.

Furthermore, the Basel Committee on Banking Supervision (BCBS), the second category was used to capture all cryptoassets which are not part of the first category. This included mostly decentralised cryptoassets, such as Bitcoin, would be subject to a 1250% risk weight, which would apply to the absolute value of the aggregate long and short positions to which the bank is exposed. The risk weight % of an asset is used to calculate a bank's risk weighted exposure to the asset, which is then multiplied by the capital requirement percentage to determine how much capital the bank must keep to cover this exposure.

Furthermore, the research emphasises that banks that take on cryptoassets exposure should undergo supervisory review processes to guarantee that the risks associated with cryptoassets handling have been effectively addressed. Many researchers argued on the robust legislation and compliance issues on the cryptoassets.

The office of foreign assets control (OFAC) came up with some sets of regulations stipulating sanctions relevant to the market. OFAC manages economic sanctions programs and issues rules that restrict transactions between persons or companies in the United States and certain foreign individuals, entities, or governments. OFAC (2021) argued that guidance for the cryptoasset industry should encourage members to approach sanctions compliance in a risk-based manner based on their specific circumstances, such as the type of business involved, the products and services offered, and the geographic locations served.

In addition to the preceding discussion, OFAC (2021) emphasised the use of specific technologies, such as geolocation and IP address blocking measures. The advice includes instances of red flags that organisations managing cryptoassets should be aware of, such as consumers who supply erroneous or missing customer information when creating an account or when asked for it.
Portilla et al. (2022) claimed that utilising cryptoassets as a means of exchange often necessitates paying an immediate tax on the gain inherent in the cryptoassets. Beyond this basic concept, much remains unanswered. The status of cryptoassets under the different mark-to-market taxation regimes that banks are sometimes subject to is uncertain, as is the tax treatment of swaps and other financial instruments using or related to cryptoassets. There is little guidance on problems that are unique and essential to the operation of cryptoassets, such as hard forks, and that information is not necessarily favourable or straightforward to implement.

Finally, the applicability of value-added taxes, property taxes, and bank taxes (including possible capital taxes) to cryptoassets is questionable. Although tax authorities will continue to explain cryptoasset taxation, ambiguity is likely to linger for a long time (OECD 2020).

Blockchain and Lending

The lending business has long faced several issues, including lengthy application procedures, fraud and security threats, and high operational expenses, to mention a few. It is hardly surprising that lenders and borrowers have been looking for an alternate, more efficient choice.

Blockchain-based lending can provide a safe approach to offer loans to a diverse group of consumers while also lowering expenses for all stakeholders. There are two primary methods of incorporating blockchain into the loan process. The first is to utilise blockchain-based goods (such as cryptoassets) as collateral for lending. The second step is to create and use blockchain technologies to expedite the loan process.

Crypto-Collateralized Lending

One of blockchain fintech's fastest developing applications is crypto-collateralized lending. A crypto-collateralized loan is exactly what it sounds like: a loan backed by crypto assets. Numerous platforms provide centralised (bank-to-borrower) or decentralised (peer-to-borrower) crypto-collateralized loans (SebaBank, 2021).

As collateral, publicly traded cryptoassets such as Bitcoin provide a number of advantages to lenders. Bitcoin holdings in relation to any borrower may be confirmed in the same way as investment assets can, and their worth is easily determined using market pricing. In a credit event, the collateral can be easily liquidated. Unlike tangible collateral (such as equipment or real estate), lenders can trace or regulate how the collateral is used since each Bitcoin is unique and each transaction is public. Finally, with new improvements in banking legislation, banks may now keep custody of cryptoassets, significantly lowering the lender's risk when collateralising loans with such assets.

While the characteristics of cryptoassets as collateral mentioned above might not appear special, the potential they provide the financial sector are. There are now more marketplaces for borrowers thanks to the new asset class. First, when lending internationally, lenders now have greater visibility into the collateral. Cryptoassets may be appraised and liquidated consistently globally at any time of year, as opposed to trying to estimate the value of collateral, such real estate, which

only has localised value and may also involve expensive currency conversion. This enables lenders to evaluate a borrower's collateral assets in real time during the loan process using programming. It also lessens the difficulties associated with enforcing liens across international boundaries, which may be difficult in a lot of places. Collateral transparency can be even more advantageous if a lender agrees to assume possession of the collateral since it completely eliminates the expenses and difficulties associated with enforcing liens across international borders. Due to foreclosure and value issues, lenders could not have previously afforded to lend to borrowers in certain regions. This implies that more people will have more access to finance internationally, especially in underbanked locations where chances for debt are frequently impeded by local regulations and localised assets. Lenders and borrowers both gain from the accessibility of cryptoasset collateral as it eliminates the need for expensive and ineffective credit checks.

One may classify bitcoin as cash, real estate for investment, a commodity, or even a generic intangible. Selecting one or the other of these might jeopardise a lender's priority if the decision turns out to be inaccurate because each of these has distinct methods for excellence. Furthermore, while having custody of the collateral helps allay worries about establishing an interest in it, different regulatory bodies have different ideas about which institutions are allowed to retain cryptoassets in custody. To enable more individuals to access finance, a unified, standard method for the creation of cryptoasset collateral and regulations pertaining to bank custody of cryptoassets are important.

Private Blockchain

Banks can also benefit from private blockchains by facilitating the transfer of funds from creditors to debtors. Through industry-wide standardisation of the lending process and the usage of verifiable documentary records by all members of a lending network, private blockchains can provide easier access to finance. In contrast to the publicly known public blockchains like Bitcoin, private blockchains give users more control over the rules governing the network. They also allow users to be authorised before being allowed to participate (also known as permissioned blockchains) and may require participant identification.

Private blockchains function by limiting network access via specific permission rules. Participants in the blockchain are restricted by certain access rules, which also restrict who may view network data, make contributions to the network, and be aware of transactions that occur on the network. Private blockchains enable more control over the network by restricting its participants, as entry may require acceptance of certain legally enforceable conditions.

Portilla et al. (2022) argued that it takes time for money to go from creditors to debtors as lenders is increased by the requirements placed on lenders by the Bank Secrecy Act and Anti-Money Laundering (AML) legislation.

OECD (2018) paper focussed on Tax reporting and information collection requirement. The OECD paper emphasized that their common reporting standard often create conflict with the FATCA from the United States. This paper argued that by enabling lenders to store debtor information or an encrypted version of it on private blockchains, which can be updated and refreshed over the course of repeat interactions and shared among approved lenders, private blockchain solutions can lower the costs associated with these requirements and increase speed.

Private blockchains improve the security of the network's data through security protocols and access controls, while blockchains usually enable participants to store and generate a permanent and verifiable record of information (ledgers) required to the lending process. The pool of lender participants authorised to use the network, such as a syndicated lending group, can then easily access documents and records of transactional interactions stored on the blockchain or accessible through it, with greater immediacy and less risk of information asymmetry than legacy processes allow.

Once information is placed on the blockchain, it can no longer be altered or tampered with unless the network's consensus rules are followed. Because of this, once debtor data related to regulatory compliance requirements is authorised by lender participants to be included on a block, it becomes unchangeable. This means that any updates to the data in the future can be compared to an accurate baseline that has been agreed upon and cannot be changed without the consent of all blockchain participants and their documentation of the change. As a result, in compliance with the applicable consensus standards, any

new data layered on a block may be inspected and verified as correct by participants more readily by comparison with a previously verified version of that information (Owoeye 2024).

Portilla et al. (2022) and Owoeye (2023) argued that the information trail on the blockchain speeds up data requests and reviews and reduces fraud. As a consequent, Developers are working on blockchain solutions outside of the banking industry to solve problems with customer identity verification and documentation. Nonetheless, this paper argued that banks are in a very good position to capitalise on the opportunity presented by blockchain technology and create the next wave of lending mechanisms since they have the most access to the customer data needed for know-your-customer (KYC) or anti-money laundering (AML) procedures related to lending.

Conversely, private blockchains have the ability to establish restricted-access networks where agreement on regulations and, consequently, blockchain modifications, may be more easily managed. Being well-established players in the market, banks may leverage private blockchains to provide innovative lending options while maintaining compliance with data privacy laws. Moreover, banks possess the option to create private blockchain lending solutions for business clients with laxer data privacy laws. Banks can use their knowledge in the business lending sector to their advantage in the consumer credit sector.

The deployment of private blockchains would also facilitate information standardisation, as they, like their public counterparts, still need consensus agreement procedures. At the moment, lending approval procedures function as separate workstreams for each loan counterparty. The same or comparable information might frequently be requested in different ways in loan transactions involving a syndicate of lenders. This results in an increase in the quantity of documentation requests that borrowers get, the effort that debtors must put up to supply the desired data, and the overall effort that lenders must expend to obtain and handle this data.

These solutions work best in an environment where all parties request and are able to process the same information, as adding information to a blockchain needs authentication by the parties involved. As a result, as private blockchains are developed for the lending industry, effort duplication across institutions can be minimised, as can the demands on debtors and the lending system overall, by having advance agreement between the participants regarding what information is needed and how it should be presented for chain addition.
Additionally, private blockchains may be utilised on the transactional side of lending to track payments and disbursements, check covenant compliance, and transfer funds. This is especially true when the blockchains are made compatible with stablecoins and cryptoassets. Lending parties may monitor each exchange between a lender and a debtor by using blockchains' ledger feature. To maintain an active record of transactions with a debtor, further exchanges (e.g., new loans or payouts) can also be documented on the blockchain (Owoeye 2024).

Private blockchain systems can let loan counterparties easily monitor each loan's current status in this way. Complete information about the debtor's current borrowing activities may be made available to previous lenders at the same time as they engage in new transactions, as future interactions between the debtor and lender on a private blockchain network can be documented on the blockchain. This steady stream of transactional data lessens the reporting requirements placed on borrowers to tell lenders of new transactions in accordance with current agreements, hence increasing openness in the lending market.

Clearance and Settlement Systems
With significantly lower fees, blockchain networks are starting to make it possible for transactions, even complicated, cross-border, multi-party transactions, to clear in a matter of seconds, around-the-clock. These advancements have the power to drastically alter the ways in which individuals move assets and money. International transactions incur particularly high settlement costs, with typical transaction fees for cross-border payments exceeding 10% and an average clearance time of two to three days (Klebanov 2021).

Klebanov (2021) argued that the period of excessive waiting time for settlement is over and significant reduced transactional fee is enhanced through the blockchain technology. This does facilitate the faster, more reliable and secure international money transfer. Banks that use the technology are expected to benefit as well since it will enable them to access underserved countries and increase their profitability by reducing some of the overhead related to using conventional international payment rails.

Portilla et al. (2022) position was argued that with Banks improved settlement capabilities, blockchain networks ought to enable instantaneous transactions with almost no costs associated with ultimate settlement. In the near future, these qualities might make previously unimaginable uses routine, such real-time streaming of cross-border payments and instantaneous settlement of financial goods. This paper argued that with this position particularly with the advanced in technology and increased awareness of the advantages of Blockchain technology.

Furthermore, building on the above discussion, blockchain network is essential. This is because its shared, decentralised database of transactions that is linked together in a chain using encryption. This is a dispersed collection of computers maintains the network, and network users agree on each transaction before it is confirmed.

Blockchain networks, according to Portilla et al. (2022) and Owoeye (2023), not only provide financial service providers a big potential, but they also mark a substantial advancement for financial inclusion and human rights. Blockchains have the ability to provide financial services to billions of people who would not otherwise have access to them by removing the financial obstacles that separate developed and poor countries and providing a low-cost network of frictionless international payments. A significant portion of international payments is made by migrant labourers who send money home to low- and middle-income nations. Blockchain networks have the potential to help those who are most in need.

Types of Blockchains Relevant in the Banking Industry

This section built on the discussions on the critical uses of Blockchains and it is imperative to discuss the types of Blockchains relevant to the Banking Industry.

Public Blockchains

According to Portilla et al. (2022), Public blockchains, like Bitcoin, are rapidly proving that they have a place in the future as layers of settlement for high transaction volumes. Initially, the throughput of public blockchains was restricted to a few transactions per second. However, with the advancement of Layer Two technologies like the Lightning Network, the throughput of blockchains has increased significantly, with theoretical limits reaching over 0.1 trillion transactions per second. Kendzicky (2018) emphasized that the users can establish peer-to-peer payment channels anchored into the underlying blockchain and then route payments across its secondary network layer by utilising the Lightning Network, a network of payment channels based on the Bitcoin blockchain.
With the same degree of cryptographic confidence as the base layer blockchain, a user may submit a payment for ultimate settlement over this secondary network in a matter of seconds and for almost nothing at all (Kendzicky 2018). This payment channel network has an internet-like architecture and may mark the start of a new financial internet in which real-time payments will be transmitted, much way data packets are now.

Portilla et al. (2022) argued that Businesses and developers are utilising this new technology by creating cutting-edge settlement platforms. For instance, Bitcoin point-of-sale and payment services are provided by payment processors like Strike and OpenNode. These apps work similarly to Square's Cash App and PayPal's Venmo since they use the Lightning Network as their backbone architecture. The main difference is that users may send money to any other Bitcoin wallet, independent of the provider. Unprecedented for settlement systems, this degree of interoperability has the potential to lead to a shift towards transparent and interchangeable financial protocols.

Private Blockchains

This paper argued that Private Blockchain is a decentralised ledger that is exclusively available to a limited number of people or organisations. It is controlled by a single operator or organisation that also has the ability to see and produce data

on the blockchain and access the network. People need to accept an invitation, confirm their identity, and submit the required data in order to enter a private blockchain network.
Furthermore, Unlike permissionless public blockchains, organisations like governments and banks may also establish blockchain-based networks to enable international asset transfers and information exchange.

According to Pymnts (2021), there are around 400 financial institutions from 78 jurisdictions that have signed letters of intent to join the Liink system; of these, over 100 are operational as of 2021, offering an indication of how future private blockchains could function.

Pymnts (2021) emphasized that private blockchain allows financial institutions and corporate users to make secure, peer-to-peer data transfers with greater speed and control by using a distributed ledger and public-private key encryption.
Examples of private blockchains include Amazon Managed Blockchain and Elements-based sidechains (separate blockchains that are attached to their parent blockchain using a cryptographic two-way peg) such as Liquid. Specifically, for financial entities, Amazon Managed Blockchain allows parties to trade and process related paperwork (i.e., ISDA agreements) in a matter of seconds without the need for a centralized authority, adding long overdue efficiency to a process that often takes days.
Compared to the typical segregated and centralised databases of today, these kinds of networks provide several advantages. They first make it simpler to comply with legal obligations, such as sanctions policies. According to Pymnts (2021), efforts should be directed on resolving sanctions exceptions that arise in cross-border transactions, cutting down on the time it takes to verify identities and addresses from weeks to minutes. Secondly, they provide simpler verification of bank details before sending payments, which reduces the expenses linked to declined transactions, especially those involving foreign entities. According to Pymnts (2021), it enables consumers to verify account details in almost real-time before starting a payment. Lastly, it assists in guaranteeing that payment messages correspond with pertinent national and currency regulations.

Hybrid Blockchain

According to Campbell (2024), hybrid blockchain integrates aspects of public and private blockchain in the financial sector. Businesses may use it to build up a private, permission-based system in addition to a public, permissionless system. This gives them the ability to manage which data is publicly accessible and who can access certain data that is recorded in the blockchain.

In a hybrid blockchain, records and transactions are normally private but may be validated upon request, for example, by granting access via a smart contract. Although protected inside the network, confidential information may still be verified. The hybrid blockchain may be owned by a private entity, but it is unable to modify transactions. A user gains complete network access the moment they sign up for a hybrid blockchain. Until they conduct a transaction, other users cannot see who the user is. The opposite person is then made aware of their identify. According to Campbell (2024), hybrid blockchains are crucial to the banking sector because they operate inside of a closed environment, making it impossible for outside hackers to launch a 51% attack on the system. In addition to preserving privacy, it permits interaction with other parties. It provides superior scalability than a public blockchain network and allows for inexpensive, quick transactions. Although information may be hidden, one significant advantage of hybrid blockchain is that it isn't entirely visible. There is little motivation for users to engage with the network or contribute, and upgrading can be difficult.

Consortium Blockchain

According to Campbell (2024), a federated blockchain, often referred to as a consortium blockchain, shares characteristics with a hybrid blockchain in that it possesses both private and public blockchain elements. However, it differs in that it is a decentralised network where several members of the organisation work together.

A consortium blockchain essentially eliminates the hazards associated with a single organisation running the network on a private blockchain by restricting access to a certain group. Preset nodes govern the consensus processes in a consortium

blockchain. Its validator node is responsible for initiating, receiving, and validating transactions. Transactions can be started or received by member nodes. According to Campbell (2024), a consortium blockchain is often more efficient, scalable, and safe than a public blockchain network. It provides access restrictions just as private and hybrid blockchain.

Consortium blockchains are less transparent than public blockchains. The network's usefulness may be hindered by the blockchain's own laws, and it remains vulnerable in the event that a member node is hacked. According to Campbell (2024), Consortium blockchains are crucial for the banking sector. There are two applications for this kind of blockchain: payments and banking. A consortium made up of many banks can decide which nodes will validate the transactions. Consortium blockchain is perfect for supply chains, especially for applications related to food and medical. In the end, industry support for blockchain technology is growing quickly along with its popularity. These new innovations show how far the blockchain sector has come in the last ten years and also suggest that authorities might need to reevaluate their previous opinions. In the upcoming years, resolving disputes related to cryptoasset settlement will be essential in deciding whether or not the world's advanced economies continue to be the hub for blockchain innovation (Owoeye 2024).

Conclusion

The financial services sector has a great deal of potential when it comes to blockchain technology. Therefore, it is imperative that the sector and the government collaborate to enable the broad use of blockchain technology in a way that is secure, sound, and provides strong consumer safeguards.

Because blockchain technology was so new when it was first developed, it may have been appropriate to take the wait-and-see approach, but now that it has evolved, action is urgently needed.
Private companies in Europe must continue to investigate the advantages of blockchain technology and implement it in workable marketplace solutions, just as other nations encourage and develop blockchain use cases, particularly in the financial services sector. They should be permitted to do so within a clearly defined regulatory framework that does not impede the development of this novel technology.

Regulators concerned with financial stability, investor protection, and market integrity are paying close attention to cryptoassets and blockchain, as evidenced by the U.S. Department of the Treasury, the OCC, and the PWG study on stablecoins.
Banks are in a good position to handle these issues. Banks may provide clients and investors in the industry confidence and protection since they have a history of serving as reliable middlemen.
Crucially, everyone involved in the financial services sector—financial institutions and the public at large—will profit from the use of blockchain technology. Blockchain technology can give otherwise financially excluded people wider and more consistent access by reducing the costs associated with financial services, possibly through collaboration between financial institutions and industry-wide standardisation of processes. Blockchain has the potential to improve cooperation between financial institutions and reinforce the banking sector's position as a trusted middleman by fostering confidence between third-party entities and enabling information transfer through methods that were not before possible.
The banking sector has a once-in-a-lifetime chance to drastically modernise itself by integrating both public and private blockchains into financial services. The legal ambiguities that currently exist in the space can be resolved and the European banking sector can increase its use of blockchain technology to offer more secure and efficient goods and services to both new and current clients by combining proper governmental regulation with collaborations between the public and private sectors.

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