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Research article

Impact of blockchain-enabled analytics as a tool to revolutionize the banking industry

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Abstract: Blockchain technology is disrupting the financial services industry and leading to extended big data applications in the banking sectors. Using blockchain and big data technology, banking industries can greatly improve decision-making, efficiency, and transparency. Nevertheless, there is a gap in research on the use of blockchain and big data technologies in banking systems from an academic viewpoint. To address the gap, we present a thorough overview of the impact of blockchain and big data technologies on banking systems. Although some banks have started blockchain development in small groups or isolation, this study was designed as a comprehensive exploration into a few facets of banking with blockchain technology to tackle the difficulties currently impeding the adoption of such technologies into banking systems throughout the world. This study shows that implementing big data and blockchain technology can significantly impact the security, speed and cost of transactions for banks. Further research could be conducted over a long-time span to capture the longitudinal impact of blockchain and big data technologies on banking in terms of the operating costs, profitability and scalability.

Keywords: blockchain; big data; banking; big data analytics; financial services

JEL Codes: M10, M21

1. Introduction

The emergence of blockchain and big data technology has effectively disrupted many industries, from banking and cybersecurity to supply chains and healthcare, while also tremendously impacting the potential of data analytics (Zhang et al., 2021). Nevertheless, with the development of cutting-edge technology in the financial services market, banks can leverage the tools to improve their offerings and reduce expenses. World Economic Forum estimates that 10% of GDP will probably be administered through blockchain-related technology or blockchains by, 2025. Blockchain technology is expected to entirely revamp the financial sector just like the Internet revolutionized the press (Bedeley and Iyer, 2014). Nowadays, nearly every bank is tinkering with blockchain technology, aspiring to improve operational efficiency and cost savings.

The existing relationship between banking systems and blockchain technology is complicated because, other than the many possibilities for streamlining conventional banking procedures, blockchain technology is considered as a risk to traditional banking business models. For instance, Boumlik and Bahaj (2017) proposed a peer-to-peer monetary process for bartering on a global scale that does not require a third party or cash. Nevertheless, because blockchain technology can offer bankers unalterable data with real-time access and consensus verification, it is unquestionably the future of banking. Wright et al. (2019) mentioned that the certainty provided by blockchains is an adequate reason for banks to rethink blockchain technology implementation. Considering that payments constitute an enormous part of banking, the market is primed for revolution (Wu and Liang, 2017). A higher speed and the nature of transactions processed via blockchain technology are the main reasons for the revolution in the banking industry. Wang et al. (2019) identified cost savings as the primary benefit of blockchain application in the long term. The origins of blockchain technology date back to the creation of blockchains as a reaction to the financial crisis of 2008.

As with the public ledger of all blockchain transactions, this primary technical development known as blockchain technology is anticipated to become very significant. For instance, Figure 1 below presents a graphical perspective on how blockchain technology can facilitate a transaction between two parties. As Sun et al. (2014) claims, blockchains not only create much larger data, but they also contribute by making big data safer and invaluable, as a blockchain can store a larger set of information in an organized way, in preparation for big data analytics. For banks, blockchain technology has the possibility to reduce expenses by reducing transaction and processing expenses. However, competitors are apt to double down on investments in new technology since various financial technology (fintech) startups have come out and provided the ability to launch a bank account with less expense. As a result, adopting blockchain technology could be the means of affecting the banking market conditions to enhance competitiveness and allowing big data to provide guidance to formulate business strategies.

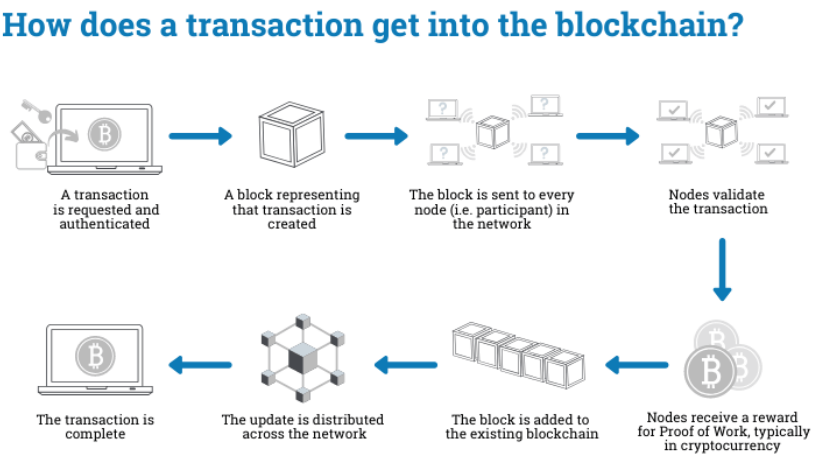

Figure 1. Blockchain transaction flow (Euromoney learning, 2022).

The above-mentioned examples provide us with a sign of the continuing blockchain revolution in the banking industry. Nevertheless, as Beck (2018) has stated, the banking industry is not fully prepared to make the most of what blockchain technology can provide. This is partially because banks do not value blockchains as a legitimate technology. In anticipation of the need for more development of and research on blockchain applications in the banking industry for both academic scientists and bankers, this study was designed to offer a thorough overview of the opportunities and issues related to the adoption of blockchain technology in banking. The advantages of blockchain use include accuracy, traceability, transparency, security, cost savings and information integrity (Sun et al., 2014). Consideration of the problems is also essential, as there are a lot of obstacles to overcome before blockchain technology can change banking. It is noteworthy that Wong and Wong (2020) have given an organized discussion about the advantages of blockchain development in a banking environment; they investigated the opportunities and issues associated with applying blockchain technology across the entire banking industry, focusing on cost savings and power efficiency. In contrast, this study comprehensively evaluates the possibilities and obstacles from the banking industry's perspective based on both academic and industrial research about the topic. Furthermore, this study may be the first and most thorough overview of blockchain application in banking thus far, as it addresses each market and constitutes an academic exploration with more than 100 research articles and publications being assessed and summarized.

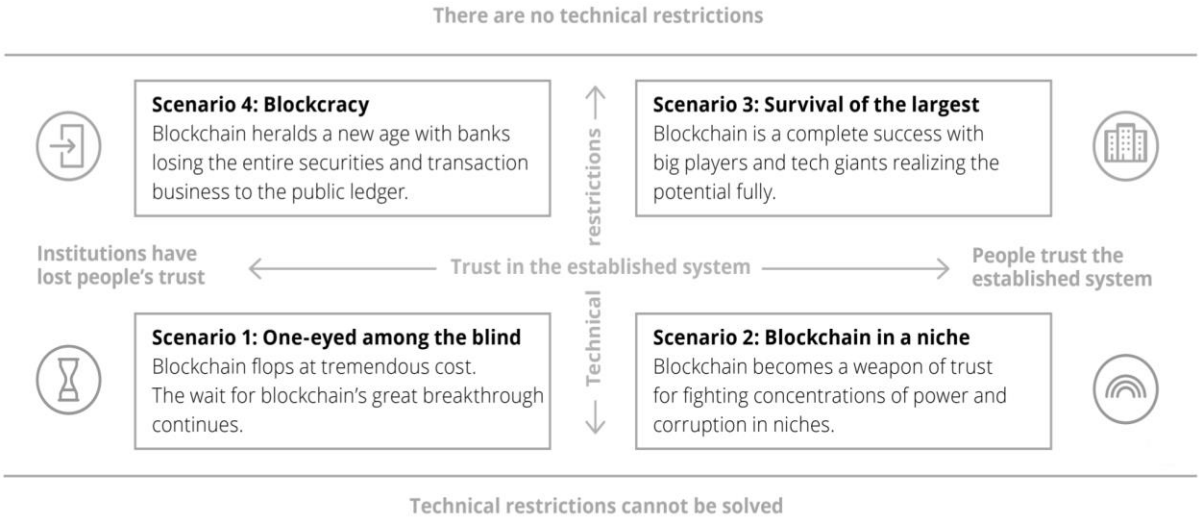

Figure 2. Illustration of the potential of blockchain technology (Thiele, 2017).

In the subsequent portion, we discuss the possibilities of banking with blockchain-based big data technology and the pre-existing obstacles. After that, we will discuss blockchain-based big data technology and present the benefits and challenges associated with banking with blockchains. Finally, we succinctly discuss the potential future of blockchains in banking.

2. Literature review

Bank-specific blockchain tasks are likely to change the financial solutions market. IBM-backed Hyperledger Fabric, the Utility Settlement Coin and R3's blockchain consortium tasks are a few examples of these kinds of instances. The foreign exchange settlement service is now supported by IBM after CLS partnered with IBM to develop a blockchain app shop for current banks in the final testing stages; it is expected to standardize worldwide forex marketplaces and minimize expenses (Bedeley and Iyer, 2014). Nevertheless, there is resistance against the adoption of blockchain technology in banking systems. For instance, although Visa is exploring the options of sending out ledger solutions, the Chief Executive Officer mentioned that they do not currently entertain the possibility of blockchain use in the core business (Treat et al., 2017). Some other banks are opting to adopt the cloud at the cost of blockchain development for the moment.

Because of the alternative perspectives, it is intriguing to think about four scenarios (Figure 2) of how blockchain may succeed, depending on two important variables: "trust in the identified system" and "overcoming specialized hurdles". This kind of delay incurs overhead expenses as well as damage, while consequences are compounded in high-frequency trading scenarios. Many studies have investigated market prediction versions, booking registrations, decentralization, etc. Likewise, a smart contract is a program included in a blockchain to facilitate, confirm and negotiate a contract agreement. Smart contracts operate as a set of preset conditions to which users agree. When circumstances are met, the conditions of the agreement are instantly applied, such as the conditions for insurance. The latest works demonstrate that open blockchain frameworks like IBM's Hyperledger Fabric procedure transactions have better security and larger workloads than standard

databases. To integrate lessons from banks, finance strategies, mobile banking and socioeconomics, the present study was designed as an inductive reasoning and exploratory approach.

There is proof that banking markets are becoming increasingly interested in the adoption of blockchain technology (Amakobe, 2015). For instance, the French investment banking group BNP Paribas has been evaluating blockchain development in the monetary fund market, and for purchase processing. Bank of Montreal, Commerzbank, Caixa Bank and Erst Group are currently working hard on "Batavia", which is a worldwide industry financial platform based on blockchain technology; it is purposed for streamlining the transfer of goods and money with higher transparency and efficiency. Meanwhile, Hong Kong Shanghai Banking Corporation performed a financial transaction for the global food and farming conglomerate Cargill, applying the R3s Corda scalable blockchain platform (Aversa et al., 2021). Along with the higher rate of the adoption of blockchain in China's, 2016 5-year strategy, more than 12 public banks have employed blockchain technology to facilitate various transactions. As a matter of fact, the Agricultural Bank of China carried out mortgage approving of USD 300,000 by utilizing blockchain technology. Bank Hapoalim in Israel is exploring the incorporation of blockchain technologies into their user-information database, while the Bank of America has submitted for 50 blockchain patents. The National Bank of Dubai is switching to blockchain implementation in the check-issuance system; also, more than 60 Japanese banks, which represent 80% of the Japanese banking sector, have partnered with Ripple, which is vying to provide alternatives to SWIFT, to permit fairly rapid overseas financial transactions. In the UK, the Santander Bank implemented Ripple's xCurrent process to permit overseas payments of somewhere between USD $10 to $10,000,000, while the Bank of England has set forth a proposition to facilitate payments and cash transfers by combining real-time gross settlement devices with blockchain technology. According to Biggs (2018), Goldman Sachs also uses its internal money to exchange blockchain futures for its clients. Oddly enough, even in Zimbabwe where the ownership of cryptocurrencies is unlawful, the Reserve Bank of Zimbabwe is believed to be thinking about the setup of blockchain technology.

Regarding primary banking-based solutions, works on Know Your Customer (KYC), bank credits, financing and interbank payments have been investigated. In the case of the stock market, there has not been much innovation. Available trading enterprises, settlements and clearing methods typically require as many as 3 days (or longer, based on the country and bank type). This means that real cash and shares are frozen for a certain length of time.

3. Methodology

Essentially, the systematic evaluation looks at blockchain exploration from three lenses. The first sort of papers focused solely on solutions for banking business. These include theoretical versions, or even empirical frameworks, with the ability for strategic changes, functional benefits or even stock market operations. The next group of papers highlight useful challenges or the scope applied in platforms, legal, organizational and technical dimensions. The third set were specific application-oriented papers utilizing conceptual/experimental methods. Once the papers were gathered, they were filtered based on key words such as "blockchain", "big data" and "banking". In total, we analyzed more than 327 papers to find out how blockchain-based big data technology is

currently being used to achieve various goals like cost reduction, increased transparency and speed, and how its application can be further enhanced by using denoising and filtering.

4. Blockchain-based opportunities in banking

4.1. Better method to know your customer

Confirming the authenticity of customer identities is an important and frequent job banks must employ for their anti-money laundering laws. Because of the increasing threat of terrorism, KYC is an important element associated with the protection against the criminal utilization of banking products, such as money laundering and terrorism. Nevertheless, KYC also presents a tremendous benefit for banks, with Wu and Liang (2017) estimating that financial institutions invest somewhere between USD 60 billion a year to operate KYC schemes. Therefore, the present KYC procedures are not just costly and ineffective, but they also result in bad client experiences for banks. Additionally, the 4th European Union Money Laundering Directive requires continuous monitoring of customer information, while the General Data Protection Regulation requires stringent control to ensure customer protection. As a result, blockchain technology, if applied properly for KYC, can be helpful. This is simply because blockchain development can eliminate the need for completing limitless KYC questionnaires when opening an account (Bedeley and Iyer, 2014). A good example of a blockchain-based KYC procedure in banking is shown in Figure 3.

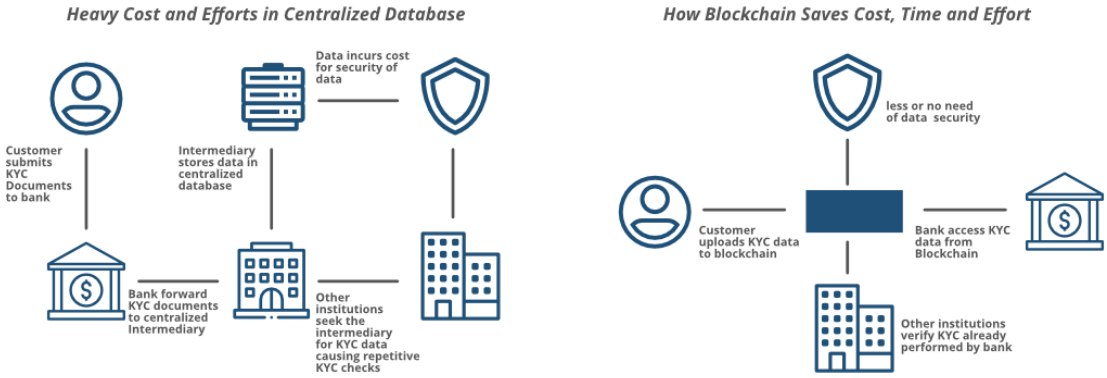

Figure 3. General blockchain-based KYC scheme (Geeksfor Geeks, 2022).

As Wang et al. (2021) has stated, blockchain technology can allow banks to analyze consumer information, thus securely streamlining the management practice by decreasing the needless duplication of requests and information. Blockchain technology has been found to help reduce duplication, as it can enable the impartial verification of a customer based on a single bank account (Niebel et al., 2019). Standardized sharing of client bank account information through the utilization of blockchain technology results in one non-editable KYC history, even further demonstrating conformity with laws. For this reason, many banks recently carried out a KYC app check over the R3

blockchain platform, while a significant Polish banking group, PKO BP, began using a blockchain-based tool for managing processes earlier in, 2020.

4.2. Improved transaction speed

While many researchers believed electronic payments had developed rapidly, the development of blockchain technology has shown that the transaction speed could be faster. The use of blockchain technology can allow banks to accelerate the time required for settlements with certainty by allowing exclusive transactions between corporations and individuals, as well as the option see the same ledger of transactions. Blockchain technology offers a higher speed of transactions because it can allow sellers and buyers to deal forex in real time, which is achieved by getting rid of intermediaries for processing transactions.

Additionally, conventional banking methods affect different requirements for funding, which result in substantial waiting times to complete one transaction. Blockchain technology allows companies to interact with higher trust by installing a shared model of transactions in real time, thus improving effective access to financial backing and not wasting time for the operation.

Vendors such as Ripple are able to complete cross-border payments in seconds, though SWIFT is trying to achieve this without using blockchain technology. Another study has indicated that almost 50% of SWIFT gpi payments have reached beneficiaries in 30 min, along with nearly 100% of payments being completed in, 24 hours. Boumlik and Bahaj (2017) proposed a more effective programming user interface comprising loop holes and achieved a transaction fee reduction of 86%. Digital banks are also using blockchain technology, with banks in India turning to blockchains to accelerate industry offers (Yu and Song, 2021). More recently, Ying et al. (2021) observed that blockchain bank account payments scale to countless transactions per hour.

4.3. Enhanced security

Protection is absolutely necessary in the banking business. As Yu and Song (2021) reported, 45% of fiscal intermediaries face financial crimes, as compared to, 27% for the manufacturing sectors. Thus, implementing an additional layer of protection is a crucial element in the next frontier of digital banking. Blockchain technology can provide increased protection for banking information, as historic information cannot be changed. Numerous entities have also addressed the insertion of brand-new information in real time, which makes it hard to adjust the information. As Amakobe (2015) has shown, any modifications to data can be monitored and administered to prevent misuse and fraud.

Blockchain technology also influences the antecedents of loyalty, such as trust, reliability, integrity, duty and predictability. The transparency contained in a blockchain’s ledger is beneficial because it will allow regulators to quickly study financial methods. Given that it is a trust-based system, customer information saved in a blockchain could be seen by reliable sources, along with the information safety measures implemented through the encryption features of a blockchain. Blockchain technology may also realize simultaneous protection and secrecy by allowing confidentiality via crucial public infrastructure, and by keeping the dimensions of a ledger.

4.4. Risk management

Since the 2008 financial crisis, there has been a rise of the development and risk management of risk control ability. In addition, mortgage-backed security is labeled as a serious risk, and this resulted in the, 2008 financial crisis. For this reason, the adoption of blockchain technology in banking can allow very low-risk transactions. For instance, the Global Debt Registry analyzes the use of blockchains to ensure the integrity of mortgage properties and guard pledged properties in the system from misrepresentation or errors down the road. Properties will be subjected to the decentralized ledger, which will generate an immutable history of every transaction. This will allow everyone in the lending environment to have confidence in—and be sure that they are looking at—the equivalent mortgage information.

Fraud minimization is yet another type of enhanced protection provided by blockchain technology. Biggs (2018) recognized fraud as being among the top functional risks. The centralized dynamics of banking methods allow it to be much more susceptible to cyberattacks, as opposed to blockchains, which are much less prone to fraud because every block has a timestamp and the blockchain maintains batches of specific transactions with a URL to a prior block. In India, there is acute interest in determining whether blockchain development is generally a way to stop bank account fraud. Nevertheless, it is noteworthy that, while numerous experts have played with the immutable dynamics of blockchains, Boumlik and Bahaj (2017) mentioned that blockchains are technically susceptible to changes. As a result, the problems pertaining to the protection facet of blockchain are discussed more below. Nevertheless, Wong and Wong (2020) believe that blockchains may be the future of encrypted information processing. While blockchains are not immune to other types of cyber risks, the unique structure encryption abilities are not contained in other solutions. This is simply because the decentralized dynamics and computations necessary to initiate improvements and make changes are extremely complex. The truth is, changing a blockchain requires control of over 51% of computer systems in the ledgers containing all prior transactions for a period of 10 min.

4.5. Cost reduction

Economics will always have an important role in the adoption of technologies, and it is absolutely no different for blockchain technologies. The banking segment will have to think about a cost/benefit analysis to figure out the feasibility of applying blockchain technology. First, the large amount of loyalty enabled by a blockchain can reduce friction, which involves many indirect and direct expenses and endeavors due to the absence of loyalty, as well as increase certainty via transactions. Keskar et al. (2021) summarized that the cross-border and permissionless options that come with blockchains could considerably lessen institutional exit expenses. In brief, Hassani et al. (2018) realized that blockchain technology can lead to remarkable cost savings for banking that are close to USD 8 billion. In a 2016 statement, Delgosha et al. (2020) implied that blockchain development may protect financial institutions from losing around USD 11 and 12 billion a year via unintentional reductions.

IBM’s blockchain app (Ledger Connect) is a good example of exactly how blockchain can assist lower back-end expenses for banks via financial businesses’ use. There is proof that the ICICI

Bank and Emirates NBD are looking into the use of blockchain development to minimize transactional expenses. In addition, banks can reduce infrastructure bills by 30% by using blockchain technology, amounting to cost savings of USD 8–12 billion yearly. Lastly, the Central Bank of India estimated expense reductions somewhere between USD 15 and, 20 billion by, 2022 as a result of using a blockchain for interbank transactions. Banks can also look to integrate fintechs as program suppliers, which may prevent damaging interaction attempts. Thus, it is apparent that substantial price reductions are possible with the adoption of blockchain technology.

4.6. Smart contracts

Contracts are complicated and time-intensive matters in the financial domain. Blockchains will be used to create smart contracts by programming and keeping a PC code, which could be applied to make contracts or maybe authorize financial transactions as soon as two or more people get their keys and meet specific Reddy requirements. Figure 4 below summarizes the procedure for root smart contracts. Cocco et al. (2018) discovered that 60% of the surveyed professionals believe that blockchains and smart contracts would be vital in the next years.

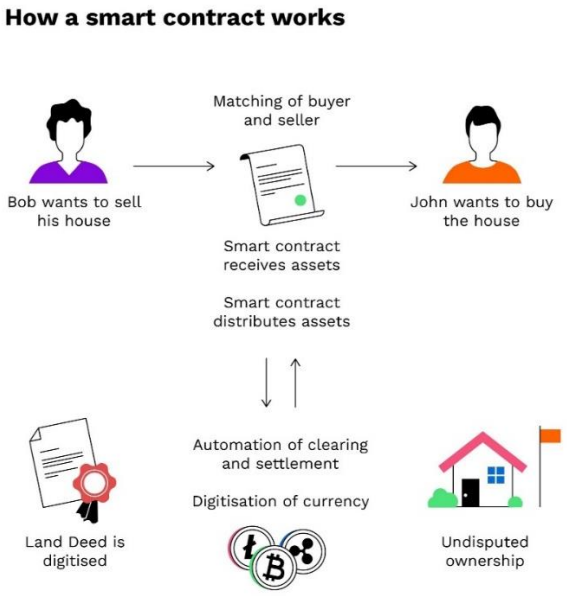

Figure 4. Smart contract scheme (BitPanda, 2022).

There is proof that the banking market is using smart contracts. For instance, Gupta et al. (2019) systematically examined the implementations of blockchain-dependent smart contracts in finance and insurance. In addition, an intelligent agreement for traveling insurance, which instantly issues and returns money, was created by Sun et al. (2014) based on the Ethereum blockchain, while the Commonwealth Bank of Australia exploited smart contracts with blockchain technology to keep track of and monitor the shipment of 17 tons of almonds (Hajiheydari, et al., 2021). Nevertheless, as Harris and Wonglimpiyarat (2019) argued, smart contracts can cause banks to shrink, as they will only be able to manage a fraction of the business in the future compared to what it does today.

Therefore, banks need to consider a means that will allow them to take advantage of smart contracts and the associated technology to benefit their decision-making.

4.7. More transactions with more transparency

As it appears, there is a lot of disagreement among those in the banking market regarding the transaction capacity of blockchain technologies. Consequently, this problem is equally an opportunity and responsibility. Presently, Visa's transaction capability is, 20,000 TPS, though development and research directly into Ethereum's Plasma multi-child-chain alternative blockchain technology has the possibility of allowing 1,000 TPS. Additionally, Japan's Mitsubishi UFJ Financial Group is also fighting with Ethereum by exploring a blockchain-based financial transaction remedy that can effectively do more than 1,000 TPS. More recently, the South Africa Reserve Bank used blockchain technology to settle the country's normal 70,000 everyday transactions in two working hours (average settlement speed: 1–2 s per transaction) while ensuring complete anonymity.

5. Potential applications of big data and blockchains in banking

5.1. Payments

Banking institutions are able to speed up payments and bring down fees by setting up a decentralized channel (e.g., crypto) for payments. Banks could compete with cutting-edge fintech companies by providing greater security and reduced costs for payment processing.

5.2. Clearance

A distributed ledger technique such as a blockchain-based technique, would allow bank transactions to be settled instantly by a bank, as well as much better monitor than present protocols like SWIFT. With our financial structure, a typical bank transfer is going to take a couple of days to settle.

5.3. Buying and selling assets

Blockchain technology is going to produce a decentralized repository of electronic assets that will change the way we view our financial markets. A distributed ledger enables the transfer of rights to an asset through the use of cryptographic tokens, which could stand for such things off-chain transactions (Wang et al., 2021). Blockchains such as Ethereum and Blockchain achieve this with only electronic assets, but numerous blockchain firms are focusing on solutions that would tokenize real-world assets like gold or property. This will also bring down the middleman fees and significantly speed up the process.

5.4. Credits and loans

The traditional banking system underwrites loans by means of a system of credit monitoring. The potential future of peer-to-peer loan programs requires a look at blockchains, which allows for

much quicker and more secure loan processes overall, as well as complicated programmed loans, which could approximate syndicated loan structures or mortgages (Bloomberg, 2018).

5.5. Identity verification

Without this, banks would be unable to conduct business online. The consumer does not like a lot of steps in the verification process. You can choose between several different authentication methods, such as face-to-face checking, authorization or some other kind of authentication. Every new provider must go through every one of these procedures for security reasons (Al-Dmour and Saad, 2021).

5.6. Auditing

Compared to other industries, accounting is relatively slow to digitize. The stringent regulatory requirements concerning validity and data integrity constitute one of the main reasons for this. This is one more area that may be completely transformed by blockchain technology (Bedeley and Iyer, 2014).

6. Challenges and risks of blockchain-based big data technology in the banking industry

6.1. Costs and standardization

The requirements for banking groups to develop a blockchain-powered product constitute a high-price affair, and given that banking groups handle most of the implementation by themselves, it ought to be standardized throughout banks. To allow KYC information to be discussed in the banking industry, for instance, Lekhwar et al. (2019) recommended the development of a common policy on the verification and identification of customers. As Biggs (2018) claims, KYC blockchain-based registries are not likely to have buy-ins for almost all banks due to their wariness regarding dependency on third-party verification of information.

As of today, each blockchain transaction fee is approximately USD 0.20 and only able to keep 80 bytes of information. Blockchain technologies will probably be hampered by the absence of harmonized market requirements unless this is resolved. Bloomberg (2018) has recommended a cash taxonomy in which the main financial institution produces a cryptocurrency (Bloomberg, 2018). In this regard, the Bank of Canada has approved the setup associated with an electronic currency, i.e., the CAD coin, which would be used for interbank transfers.

The price of storage space is also a key concern related to blockchain-based banking methods. Several analysts believe the price of storage space will reach USD, 22,000 per year. Beck (2018) believes that, because of technical requirements, blockchain technoloby in banks is not practical. To promote the wide adoption of blockchain technology, identity validation offerings will be essential, as they would allow the banks significantly contribute as reliable businesses. The issue remains as to whether the price cost savings caused by utilizing blockchain technology will exceed the expense of keeping the product.

6.2. Currency stability

Bankers are not ready to accept blockchains as a type of currency. The consideration of blockchain-based cryptocurrencies such as Bitcoin and Ethereum is but one leading problem of blockchain payments in banking, particularly since the cryptocurrency sector is volatile. Stability in the currency sector is vital. Indriasari et al. (2019) mentioned an earlier proposal of a stable coin rather than volatile cryptocurrencies, and that it is essentially an electronic token that should have reasonable volatility. An outcome will be pitted against some underlying fiat currency, therefore acting as a store of value, place of exchange and product of accounting for blockchain payments. A single stable coin is Stronghold USD, which is protected by the USD build up and currently under improvement as a reputable token for blockchain payments at IBM. One more electronic coin is known as the Energy Settlement Coin, which is supported by six of the biggest banks. It was designed with the goal of allowing financial institutions to send one another.

6.3 Protection

The security component presents challenges and opportunities for blockchain adoption in banking. Banking is a very anchored sector. Bankers historically needed to focus primarily on safeguarding their deposits. With all of the challenges in web-based banking, a new protection risk from online hackers has emerged, mandating the development of a sector for cyber safety measures and increasing the expense for banks. In the past few years, cyber strikes have led to losses in the banking market amounting to USD hundreds of millions. Therefore, banks are careful to not allow their financial data to exist outside of their protected firewall.

Miners can confirm the data in the blockchain as a protection mechanism, but this tends to be bothersome because transactions are irreversible. Satoshi Nakamoto described a 51% attack, which means that one-half of the computer systems doing work as nodes to service the system see a fabrication. Nevertheless, there continues to be secrecy in blockchain development because transactions will be noticed in the system nodes that create meta information, resulting in pattern recognition. But, a strategy for secrecy issues is “self-sovereign identity”, which allows customers to manage their own informatino and have much better control. It is also worth noting that blockchains are safer than a centralized method. The anonymity element of blockchains presents an additional protection layer. These untraceable transactions will threaten the banking segment and regulators because they would add to the trouble of taxing and might help crooks with fraud and money laundering. Cryptographic strategies such as zero-technology proofs enable transactional correctness and block verification without revealing the specific details on the transactions, protecting secrecy at the optimum level. Many more countries are shifting toward initial coin offering and crypto legislation as a probable fix.

6.4. Legislation and regulations

In a comment by Lekhwar et al. (2019), the experts dealt with the significance of setting up a regulatory sandbox; they suggested that the setup and functioning of a blockchain will likely have a limited range but maintain adequate room for functionality. The white papers related to central bank

guidelines and bank privacy laws negatively affect the adoption of blockchain technology by banking groups, with federal treatment to be obstructed more by lobbyists fighting for this revolution. The General Data Protection Regulation laws and regulations prevent the complete utilization of blockchain development in banking. The statement implies that the regulators are helping banks to adopt blockchain-favorable regulatory frameworks, although other experts are urging central banks to begin adapting to blockchain technology. But, Ying et al. (2021) believed that each group of financial transactions will likely follow the standard format, and that that challenges the federal government and institutions that have overseen and controlled the transactions for decades.

6.5. Scalability

It is agreed that blockchains have minimal transaction capability. Scalability is among the key issues with blockchains according to Wong and Wong (2020). Blockchains are always secure and decentralized, but they do not scale well. Technically known as the "scalability trilemma", this is one of the properties of decentralization, scalability and security that banks must choose. Research and development are required to improve the scalability of blockchain technologies to enable a lot more transactions than other platforms, like Visa. There is also misalignment between the scope of blockchains, as Aversa et al. (2021) stated. At present, a blockchain can process just 7 TPS, as compared to Visa's 30,000 TPS. Moreover, several central banks, e.g., De Nederland's Bank, think that, due to scalability limitations for big transactions, ledger development is not ideal for current financial transaction infrastructures. Scalability concerns accompanied by large energy consumption indicate that blockchain is better suited for general banking than mass banking.

6.6. Standard risks

Blockchain technology exposes institutions to risks like those related to existing business processes, but it introduces nuances for which entities have to account (Bedeley and Iyer, 2014). Because of the inherent nature of blockchains, all of the data in a chain will always be present for the foreseeable future. If a banking system wants certain data to be erased because of privacy reasons or business needs, it will not be possible with the current blockchain architecture.

6.7. Benefit transfer risks

The blockchain allows the transfer of value from peer to peer with no requirement for a central intermediary. The type of value transferred can be either assets, information or identity. This innovative business model exposes new risks to the interacting parties that were formerly handled by central intermediaries (Wang, Lin and Luo, 2019). Since there are no governing bodies, any decision made will depend on a consensus mechanism, which may not always indicate what is right.

6.8. Smart contract risks

Smart contracts could possibly encode complex business, legal and financial arrangements in the blockchain, which could end up mitigating the risk related to the one-to-one mapping of these

arrangements from the physical to the electronic framework (Bloomberg, 2018). However, in the case in which a term or condition is not followed exactly as previously determined, it will prevent smart contracts from being executed. So, it brings a risk of failure to execute in the case of previously unnoticed or unforeseen issues.

7. Discussion

The big data revolution will continue to develop, and blockchain technology will increase the usage of big data in banking and impact the trading or exchange platform. Blockchain technology is effective, as it applies software programs and infrastructure to manage substantial quantities of information. Blockchains will foster organized big data, though the evaluation would certainly need to be able to deal with many issues, which has been an issue for big data (Aversa et al., 2021) since before the development of blockchains. This suggests that, in the case of the banking market, investments in the development of and research on denoising techniques and signal removal in big data will probably be worth the effort. For instance, let us think about the quantity of blockchain transactions, as a short time is required to complete a certain number of transactions. This seems affordable considering that, if the financial institution takes advantage of the opportunities provided by blockchain technology, the whole world might be engaging in transactions down the road. The proxy period sequence record information corresponding to 1680 s on July, 26, 2018 to August, 2, 2018 is presented in Figure 5. We used a forecasting and filtering method known as singular spectrum analysis (SSA) to denoise and draw out indicators of blockchain transactions. In Figure 5, SSA (L, r) describes the SSA options duration L, and how many eigenvalues are utilized in the filtration system to complete blockchain transaction, r.

The initial sequence was relatively raucous, with outliers impacting the extent over the corresponding period; for example, the genuine signal is concealed to the naked eye. We used SSA to denoise the sequence and initially extracted a smoothed signal (periodic fluctuations) and determined the trend of the transaction information. Also note how the SSA (520, 1–3) decomposition and reconstruction allowed us to determine the basic periodic fluctuations and trend patterns in blockchain transactions per second. The outliers in the raw period sequence were not a portion of the filtered transaction sequence. This was able to promote much better choice planning and decision-making when the banking product was able to be used to determine the occasions and times corresponding to troughs and peaks in blockchain transactions; additionally, we observed more effective programming of energy-related resource allocations and systems, which guaranteed absolutely no slowdowns or outages during the transaction peaks, while also providing much better power allocations in shorter times. In the reduced half of Figure 3, we incorporated more indicators in the SSA (520, 1–10) graph to demonstrate a much better indication of every second's legitimate blockchain transaction movements. The last graph, SSA (520, 11–520), shows the racket extracted via the SSA. Here, it is apparent that the outliers were filtered, reducing the number of arbitrary components in the information and allowing for much more correct choice generation. Additionally, these kinds of denoising attempts would certainly help banks to better forecast succeeding motions in blockchain transactions, as the arbitrary components (noise) are reduced, which would allow forecasting designs to yield a much better match for the information.

8. Conclusions

After a big data-based revolution in banking, blockchain technology has introduced control to the system, and it does not merely afford many possibilities, but it also threatens current company models in the banking industry. This paper began with a brief description of the evolution of blockchain in the banking industry, and our exploration demonstrates an absence of academic interest. With a goal to motivate more development of and research on blockchain and big data technology in banking, we examined more than 100 reports (mostly business-related and a few academic reports); we have presented the opportunities and problems associated with the adoption of blockchain technology in banking.

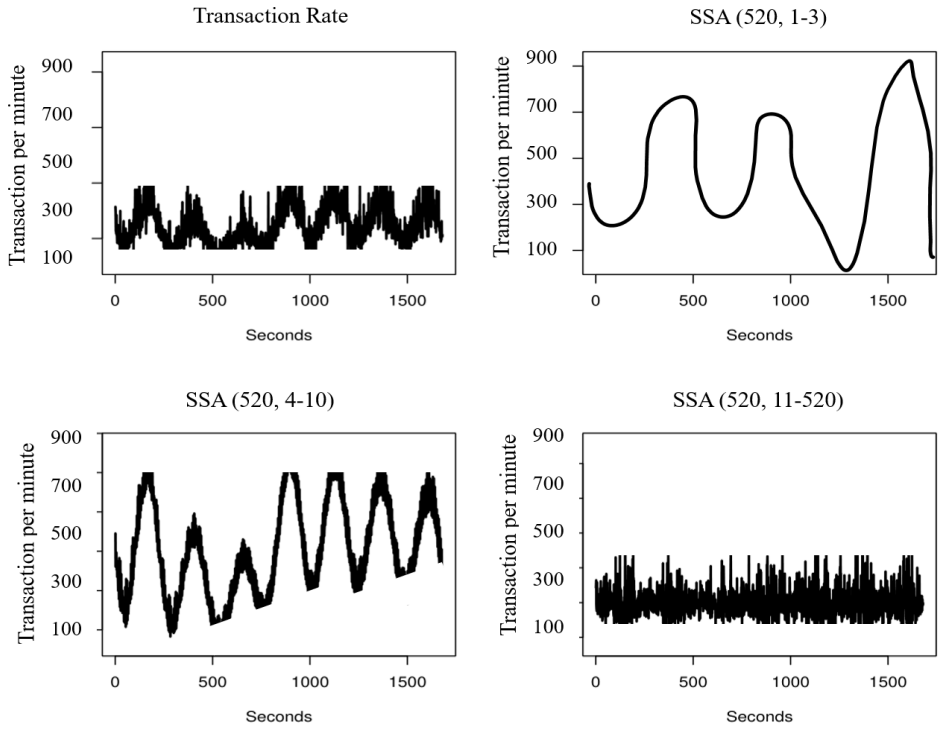

Figure 5. Denoising transactions per minute.

The key possibilities are enhancements to security, transaction speeds, KYC processes, smart contracts, cost reductions and transparency, as well as the possibility of boosting the number of transactions that a bank account can make in a certain time. Regarding the additional concerns that banks face when attempting to apply blockchain technology, there are fixed and operating expenses, standardization needs, the need to balance all currency, protection requirements, regulations and scalability. The possible lack of development and research for this specific segment is of concern, though most difficulties could be tackled by performing comprehensive research studies. This paper will ideally help to determine pre-existing research areas in big data-based banking and encourage more academics, bankers and researchers to find answers to the difficulties while boosting pre-existing options. Furthermore, this paper discusses the benefits of filtering and signal removal methods in the banking industry. It shows the way the banking market might take advantage of

research on filtering big data and signal removal, since it seeks to contribute to blockchain development and grow in activities.

There is an absence of research on the feasibility and utilization of blockchain technologies in the banking industry. The opportunities will certainly exceed the risks, and the regulators would also be smart to view the advantages that this revolution has for the banking industry. Blockchain development is equally vital as big data continues to develop. In an era in which technology dictates survival in a volatile and competitive sector, banks should decide whether they will innovate with blockchain-based big data technology or take a risk to remain behind and sacrifice the competitive advantage in a rapidly developing environment.

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