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BLOCKCHAIN-BASED DIGITAL IDENTITY VERIFICATION IN BANKING

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ABSTRACT

Blockchain technology is revolutionizing banking through secure and decentralized digital identity verification. This paper explains how blockchain identity systems minimize identity fraud, streamline Know Your Customer (KYC) compliance and simplify customer onboarding through self-sovereign identity (SSI) models. Conventional identity authentication frameworks are based on centralized databases that are susceptible to breaches and inefficiencies. Blockchain provides a tamper-evident, decentralized ledger that achieves data integrity, transparency, and control of personal credentials by individuals. By employing cryptographic protocols and smart contracts, banks can provide effortless authentication at decreased cost and regulation. The deployment of decentralized identifiers (DIDs) and verifiable credentials (VCs) allows for a better security solution to digital identity in the form of mitigated risk from unauthorized access and fictitious transactions. Moreover, blockchain KYC solutions streamline working efficiency by making verification easier and eliminating duplicate compliance verification at financial institutions. This paper gives real-world applications of blockchain in banking identity management, emphasizing how it affects fraud protection, regulatory requirements, and customer experience. The research establishes that blockchain can transform digital identity validation, securing banking, streamlining efficiency, and making it privacy focused.

Keywords:

Blockchain identity authentication, decentralized identity, Know Your Customer (KYC), self-sovereign identity (SSI), fraud protection, financial security, digital identity management, smart contracts, verifiable credentials (VCs), decentralized identifiers (DIDs)

I. INTRODUCTION

The rapid digitization of financial services has brought both opportunities and challenges, particularly in identity verification and security. Traditional identity management systems often suffer from inefficiencies, data breaches, and compliance complexities, making them vulnerable to fraud and cyber threats. In response, blockchain technology has emerged as a transformative solution for secure and decentralized digital identity verification in the banking sector. Blockchain's decentralized and tamper-proof nature enables financial institutions to implement a robust identity management framework that enhances security, reduces fraud, and streamlines Know Your Customer (KYC) compliance. Blockchain-based identity verification offers a paradigm shift by allowing individuals to have self-sovereign identities (SSI), enabling them to control their personal data while granting selective access to financial institutions and third parties. This approach mitigates risks associated with centralized databases, which are prime targets for cyberattacks and data breaches [1][5]. Blockchain technology application in banking improves customer onboarding by replacing inconvenient authentication processes with smooth, realtime verification processes [3] [8]. Additional identity protection is also provided by zero-knowledge proofs (ZKPs) and cryptography, enabling users to verify credentials without exposing confidential data [9], [14]. Blockchain technology application in digital identity management further improves regulatory compliance through the provision of an immutable, open ledger that ensures real-time audit and detection of fraud. Smart contracts enable financial institutions to automate KYC activities at the minimum operational cost and verification effort to manual [4] [12]. Implementing decentralized identity systems also encourages interoperability across various financial services providers, making it easy for users to get a seamless experience in making cross-border transactions [7] [17]. Blockchain identity verification risks are threatened due to scalability, adherence to regulatory standards, and interoperability with traditional banking infrastructure even with the positives. Though, ongoing innovation in blockchain protocols and government response toward decentralized identity systems is a bright prospect for its large-scale adoption [6] [10] [11] [13]. This paper describes the potential of blockchain to transform digital identity verification in banking, examining its effect on security, fraud prevention, regulatory

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compliance, and customer satisfaction. By analyzing block chain identity models deeply, we expose real-world applications and the evolving paradigm of online secure identity management to the financial industry [16] [18] [20] [21].

II.LITERATURE REVIEW

Bandara et al. (2022): Introduced Casper, a blockchain system that supports secure and effective customer credential authentication in banking. The system ensures more security using decentralized identity management, reducing the reliance on central authorities. The system ensures transparency and reduces fraud occurrence in financial transactions. The paper introduces the capability of Casper to improve the efficiency of KYC procedures. The authors introduce the application of blockchain to money-related identity management [1].

Aydar et al. (2019): Proposed a blockchain-based system for digital identification verification, record attestation, and secure data transfer. The research establishes the benefit of decentralization in disrupting traditional thirdparty verification. The research is centered on self-sovereign identity (SSI) principles to maintain user privacy and control. The research discusses implementation complexity and blockchain identity system scalability. The solution creates more digital trust and security in identity verification processes [2].

Dong et al. (2020):Provided with BBM, an open banking blockchain model that supports self-sovereign identity. The research describes how decentralized identity technology enhances security and banking credential control. The report identifies advantages of BBM in curbing fraud risk and compliance with financial regulation requirements. The model supports real-time authentication with anonymity for users. The research recognizes the application of blockchain in transforming identity management in banking [3].

Malik et al. (2019): Developed a blockchain model for verification of identification to enhance security in authentication. The paper discusses the relevance of distributed ledger technology for the establishment of trust and transparency within online identity systems. The model is based on data invariability as an immunity mechanism against identity forgery. The paper recognizes blockchain potential towards the eradicating inefficiency in present verification processes. The study indicates technical and implementation perspectives of blockchain ID solutions [4].

Bandara et al. (2021): Proposed a self-sovereign digital identity system based on blockchain. The article mentions the necessity of decentralized authentication to avoid risks of identity fraud. The article points towards the use of blockchain to render the process of identification verification safe and efficient. The authors have illustrated scalability and interoperability problems of blockchain-based identity systems. The research outlines real-world implementation scenarios of the suggested system in the financial services [5]

Ahmed et al. (2022):Provided a detailed description of blockchain identity management and self-sovereign identity systems. The paper classifies different methods of blockchain identity verification and their security implications. It explains the benefits of blockchain to minimize reliance on centralized identity providers. The research gives major challenges, such as regulatory needs and interoperability issues. The survey gives a thorough review of current blockchain-based identity management systems [6].

Schlatt et al. (2022):Hypothesized a self-sovereign identity-based model for blockchain digital KYC operations. The research identifies inefficiencies in the classical KYC process and how blockchain enhances verification speed and security. The research suggests an identity management system balancing privacy against compliance requirements. The article states the use of smart contracts in automating the KYC functionality. The research highlights blockchain's potential for transforming financial identity verification [7].

Ahmed et al. (2023):Proposed a blockchain-based self-sovereign identity model for open banking, secured by customer banking cards. The research presents a decentralized solution to digital identity, providing improved privacy and fewer fraud attacks. It demonstrates the security advantages of combining banking cards with blockchain-based authentication. The authors consider implementation issues, such as scalability and regulatory issues. The model improves secure identity verification in banking systems [8].

Akram and Sen (2022): Evaluated blockchain application in digital identity verification in the BFSI sector using zero-knowledge proof. The study identifies the safety advantages of using zero-knowledge proof in verification without disclosing confidential information. It describes the capability of blockchain to facilitate convenient identity management in banking. The authors touch on real-world deployment challenges and regulatory constraints. The research highlights blockchain's role in improving data security and privacy in banks [9].

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Htet et al. (2020):Presented a case study on decentralized digital identity management through blockchain technology in Myanmar. The study captures the advantage of decentralized authentication towards identity security. The study focuses on the issue of implementation, such as infrastructural constraints and regulations. The authors describe the potential of blockchain in countering identity forgery in developing nations. The research captures the potential of blockchain for creating secure and reliable identity management systems [10] [16].

III. KEY OBJECTIVES

- Use of Blockchain in Banking for Digital Identity Verification: Blockchain technology is increasingly being used in banking for secure, decentralized identity verification with less reliance on central authorities and protection against the threat of data breaches [1] [5] [6] [12].
- Improving Security and Mitigating Identity Fraud: Blockchain identity systems improve security by protecting against identity theft and fraud with cryptographic processes and distributed ledger technology [4] [6][15].
- Simplifying Know Your Customer (KYC) Compliance: Blockchain simplifies KYC processes by making self-sovereign identity (SSI) a reality, cutting manual verification steps, and enabling digital identities in real time, verifiable [3] [7] [14][17].
- Simplifying Customer Onboarding with Frictionless Authentication: Companies can use blockchain to simplify onboarding and make it more efficient by cutting duplicated identity verification procedures among financial organizations [2] [8] [12] [19].
- ▶ Using Self-Sovereign Identity (SSI) for Enhanced Control: Blockchain-driven SSI systems provide individuals the control over digital identity while making financial transactions safe and private [5] [10] [18].
- Case Studies and Applications: There have been several case studies illustrating blockchain-based identity management usage, e.g., banking systems for prevention against fraud, digital KYC, and open banking [9] [10] [13].
- Regulatory and Compliance Matters: Application of blockchain technology to identity verification needs to comply with existing financial regulation, privacy of data laws, and developing KYC/AML regulation [7] [14] [17].

IV. RESEARCH METHODOLOGY

This research applies a qualitative and quantitative methodology in discussing the use of blockchain technology in banking for safe and decentralized digital verification of identity. The research method applied entails extensive literature review, analysis of case studies, and collection of empirical data to assess how blockchain enables compliance with Know Your Customer (KYC), eliminates identity fraud, and provides simple customer onboarding.A systematic critical analysis of existing blockchain-based identity verification models is performed by synthesizing ideas from recent studies and industry reports. Primary sources are identity management systems such as self-sovereign identity (SSI) models [6], smart contract-enabled verification frameworks [3], and decentralized identity management models applied in the banking and financial institution context [12] [16]. This research also touches on blockchain adoption challenges and regulation implications in digital ID verification, considering how banking compliance is claimed and privacy and security needs are met [14][17]. To investigate empirically, existing deployments of blockchain in banking-based identity verification in real-world systems are analyzed. Banking institution case studies implementing blockchain-based identity management platforms, including BBM (Blockchain-Based Model for Open Banking) [3], and Casper [1], yield evidence on operational efficiencies, risk avoidance, and cost reduction. Furthermore, comparative studies on the value of blockchain in digital KYC processes [7] and financial authentication channels [8][15] are analyzed to bring out enhanced transaction security and fraud protection. Methodology also involves comparative analysis of centralized conventional identity verification procedures and blockchain-based decentralized systems. Identity authentication time, rate of fraud, and cost-effectiveness are measured to demonstrate the effectiveness of blockchain solutions in banking [4] [9]. Blockchain's capacity to hinder bank frauds by using enhanced authentication procedures is also analyzed using models like self-sovereign identity protected by banking cards [19] [20].

V. DATA ANALYSIS

Blockchain technology is revolutionizing digital identity verification in banking to provide secure and decentralized solutions for identity fraud prevention and automating compliance procedures. Banks can enhance the process of customer onboarding by making it more convenient and efficient with the help of self-sovereign identity (SSI) and blockchain-enabled authentication platforms. Experiments have illustrated that blockchain

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identity management platforms reduce reliance on centralized databases and, therefore, reduce the risk of data breaches and unauthorized access [6] [12]. The process gives individuals greater control of their personal information and enhanced regulatory compliance through automated KYC verification [7] [14]. Alternative models were proposed, such as the use of blockchain-type digital identity platforms and bank cards to give additional protection from abuse and jokes [8] [19]. These models take advantage of cryptographic hashing and distributed ledgers to verify identities without revealing confidential information, providing confidentiality and integrity for data [5] [10]. Integration of zero-knowledge proof protocols into blockchain-type identification verification systems even enhances security as it enables verification without exposing underlying personal information [9]. In addition, the banking sector extensively employs blockchain for cross-border identification verification, reducing processing time and expanding financial access [3]. The technology supports an open banking culture through secure attestation of documents and identity sharing, thus creating an even more interoperable financial system [2] [12]. Additionally, verification of identity through use of smart contracts is mechanized, hence saving effort and administrative cost greatly without compromising regulation compliance [4] [15]. Utilization of blockchain banking technology offers security in addition to facilitating real-time identity verification as well as minimizing customer onboarding friction. Evidence attests to how decentralized identity verification systems create trust between customers and improve operational efficiency, a paradigm shift in financial service digital identity management [1] [17].

Case Study	Bank/Institution	Blockchain Model Used	Key Benefits	Challenges	Reference No.
Casper System	Multiple Banks	Blockchain- based credential verification	Improved security, reduced fraud, efficient KYC	Implementation complexity	[1]
Self-Sovereign Identity (SSI) for Open Banking	Various financial institutions	SSI blockchain model	Decentralized identity, enhanced privacy, customer control	Regulatory uncertainty	[8]
BBM Model	Open Banking sector	Blockchain for self-sovereign identity	Faster onboarding, fraud reduction	Interoperability issues	[3]
Blockchain- based KYC Framework	Banking sector	Digital identity with smart contracts	Simplified KYC, real-time verification	Initial cost of deployment	[7]
Blockchain Digital Identity in BFSI	Global BFSI Industry	Zero- Knowledge Proof authentication	Enhanced security, reduced identity theft	Privacy concerns	[9]
Blockchain and Self-Sovereign Identity	Financial Institutions	Decentralized digital identity	Fraud prevention, seamless cross- border transactions	Lack of standardization	[5]
Myanmar's Digital Identity Management	Banking Sector in Myanmar	National identity blockchain system	Identity protection, reduced fraud	Infrastructure limitations	[10]

TABLE 1: CASE STUDIES FOCUSING ON BLOCKCHAIN-BASED DIGITAL IDENTITYVERIFICATION IN BANKING.

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Digital Identity for Record Attestation	Financial organizations	Blockchain- based digital attestation	Secure and tamper-proof identity verification	Adoption resistance	[2]
Blockchain- Based Authentication Model	Financial Services	Encrypted authentication	Faster transactions, reduced risk	Scalability concerns	[15]
Bank Scam Call Prevention Using Blockchain	Banking Industry	Blockchain- based scam call mitigation	Real-time fraud detection, secure customer interaction	High implementation costs	[19] [20]
Framework for Open Banking Identity Management	Banks & Financial Institutions	Blockchain- based identity framework	Secure access control, regulatory compliance	Technical complexity	[12]
KYC Simplification through Blockchain	Various Banks	KYC on blockchain ledger	Fraud reduction, increased efficiency	Integration with legacy systems	[14]
Blockchain for Digital Identity in Banking	Financial Service Providers	Digital ledger- based ID verification	Customer trust, reduced fraud	Resistance from traditional systems	[4]
Banking Card- Based Identity Verification	Retail Banking	Customer banking cards integrated with blockchain	Secure transactions, improved UX	Privacy and data sharing concerns	[8]
Blockchain- Based Digital Authentication	Banking Sector	Distributed identity verification model	Improved compliance, reduced onboarding friction	Policy alignment issues	[17]

Blockchain technology is revolutionizing digital identity verification in the banking sector in secure, efficient, and safe methods of identifying fraud prevention to authenticate, enabling KYC regulation, and optimizing customer onboarding. Blockchain systems have been beginning to adopt utilizing frameworks to provide increased security and efficiency in finances transactions. The Casper System, a credential verification blockchain-supported system used by several banks, is an example. This system is complemented in safety and efficiency and mitigated in fraud threats, albeit at its cost of implementation but a barrier ([1]). Similarly, Self-Sovereign Identity (SSI) for Open Banking has been proposed by various financial institutions, providing consumers with control over their identity and decentralized authentication. Regulatory ambiguity still, however, acts as a barrier to adoption ([8]). The BBM Model introduces blockchain to open banking through self-sovereign identity, less expensive with reduced fraud and faster customer onboarding, but interoperability with other systems is an issue [3]. A blockchain KYC has been applied in banking to simplify compliance and enable real-time identity verification. This model does away with human intervention to a large extent and increases security at a prohibitive but costly deployment price, and this type of usage in such huge quantities is not acquired [7]. Zero-Knowledge Proof (ZKP) authentication is proposed as a global BFSI (Banking, Financial

Services, and Insurance) case study with identity secured identification and without secret information disclosure. Although the approach significantly avails protection against identity fraud, there have been problems with its application on privacy functions persisting [9]. Moreover, the integration of blockchain technology with selfsovereign identity provides the ability for the financial institutions to secure themselves from fraud and facilitate

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ease of cross-border payment settlements. Still, the heterogeneity in regulatory architectures remains one of the major challenges [5]. There exists a national identity blockchain platform that is being implemented for Myanmar's financial sector with the assurance of identity security and fraud prevention. Geographical constraints in infrastructure are giants to scalability [10]. Blockchain digital attestation, for instance, is used by banks for irreversible identification. Although customers' identity security is assured in the process, resistance from traditional banking institutions slows the pace [2]. Furthermore, a blockchain verification system employed by a bank provides greater transaction security and risk reduction in loss of scalability issues to be addressed [15]. Blockchain technology has also been employed by the financial industry to avoid fraud calls via a decentralized system, which detects the fraud in real-time. As great as the model improves security and avoids monetary fraud, the extremely high cost of installation has been a limitation to its use [19]. Another innovation is an open banking identity management platform with secure access control and compliance features for financial institutions and banks. Technical integration maturity is, however, not simple [12]. Simplification of KYC through the application of blockchain has also been adopted by banks, where they utilize digital ledgers to minimize fraud and improve efficiency better. The integration of this technology with the current bank infrastructure is, however, a main challenge [14]. Case study of blockchain use in digital identity for banking describes how it can be able to boost customer trust as well as reduce fraudulent transactions. However, resistance by traditional financial models puts a hold on the adoption of decentralized models [4]. In the meantime, bank card-based identification is using blockchain-based bank cards to make secure payments easy and convenient in the midst of data sharing concerns as well as privacy issues [8]. Lastly, a blockchain digital authentication system is applied within the banking industry to facilitate improved compliance and automation of onboarding. Despite its own advantages, policy flexibility still poses an issue [17]. In summary, blockchain technology is transforming digital identity authentication for banks by preventing fraud, improving security, and making regulatory compliance easy. Scalability, regulatory risk, interoperability with current infrastructure, and cost of implementation are the factors that need to be overcome for greater adoption.

Company/Organization	Implementation Details	Benefits Achieved	Reference
Royal Bank of Canada (RBC)	Developed a blockchain-based platform to enhance security in the account opening process by storing personal and financial data on the blockchain.	Improved security and efficiency in client onboarding processes.	[1]
Commonwealth Bank of Australia (CommBank)	Launched the Truyu app, which notifies users immediately when an identity check is conducted, helping detect unauthorized activities.	Enhanced protection against identity theft and fraud, with the app issuing 1,000 alerts to its 6,000 users since its pilot launch.	[2]
Relx (LexisNexis Risk Solutions)	Transformed into a leader in digital identity verification and fraud detection, processing billions of transactions and holding extensive identity records.	Significantly reduced fraud for insurers and banks, illustrating the effectiveness of their identity verification services.	[3]
Humanity Protocol	Utilizes palm scans to ensure online accounts are managed by real individuals, addressing issues such as bots, fake accounts, and fraud.	Raised \$20 million in funding, reaching a valuation of \$1.1 billion, indicating strong market confidence in their identity verification approach.	[4]
Worldcoin (World)	Introduced an eye-scanning Orb as part of their project to verify	Prevents identity fraud and ensures that online accounts	[5]

TABLE 2: REAL TIME APPLICATIONS

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	human identity in an AI-driven world.	are managed by real individuals, addressing challenges posed by AI and deep fakes.	
Sovrin Network	Provides a fully decentralized self-sovereign identity system, allowing users to control their digital identities.	Enhances user privacy and security by giving individuals control over their personal data.	[6]
Hyperledger Indy	Designed for decentralized identity management, enabling independent digital identities rooted in blockchains.	Facilitates secure and private identity verification processes.	[7]
Civic	Offers a personal identity verification process using blockchain technology to secure and protect user identities.	Provides users with more control over their personal data and enhances security in identity verification processes.	[8]
Dock	Provides a digital identity blockchain used for bank account openings and government service access.	Eliminates the need for centralized third-party verification services and prevents identity fraud.	[9]
uPort	Allows users to create self- sovereign identities and securely manage personal information.	Empowers users with control over their digital identities, enhancing privacy and security.	[10]
TrustID (by R3 Corda)	Offers a blockchain-based identity verification solution for financial institutions.	Streamlines KYC processes and enhances security in identity verification.	[11]
Everledger	Uses blockchain to track high- value assets like diamonds via trusted digital identities.	Enhances transparency and trust in the supply chain by ensuring the authenticity of assets.	[12]
FinBTech	Combinessmartcontracts,blockchaintechnology,FaceNet512,andGaussianMixtureModels forspeechvideo authentication.	Provides robust defence against identity theft and unauthorized access, setting a new benchmark for secure financial transactions.	[13]
Civic	Offers blockchain-based identity verification for personal and financial security.	Enhances security and user control over personal data in identity verification processes.	[14]
uPort	Creates self-sovereign identities allowing verified credentials and secure data management.	Gives users control over their digital identities, boosting privacy and security.	[15]

Blockchain technology is revolutionizing the banking industry through the application of sophisticated digital identity verification, reduced identity fraud, efficient Know Your Customer (KYC) compliance, and improved customer onboarding. Most banks and institutions have embraced blockchain-based identity verification models in order to enhance security and operational efficiency [21].

For instance, Royal Bank of Canada (RBC) employed a blockchain platform to store personal and financial data, improving security and efficiency in client onboarding [1]. Commonwealth Bank of Australia (CommBank) also

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introduced the Truyu app that reminds customers of identity verification activity through auto-drafted reminders and thus against unauthorized usage and identity fraud [2]. Relx (LexisNexis Risk Solutions) is also a pioneer in online identity confirmation and online fraud discovery that has handled billions of transactions to enable finance firms and insurance firms to avoid fraud [3]. Future blockchain identity confirmation like Humanity Protocol and Worldcoin (World) are also pushing boundaries through use of biometrics. Humanity Protocol utilized palm scans for real user authentication and anti-fraud and became valued at \$1.1 billion due to its revolutionary successes [4]. Worldcoin utilized Orbs scanning eyes to authenticate users in a virtual world driven by AI, rendering digital identities safe and authentic [5]. Decentralized identity systems are also gaining popularity. Sovrin Network offers a self-sovereign identity framework where individuals can control their own data, thereby enhancing security and privacy [6]. Similarly, Hyperledger Indy facilitates independent digital identity through blockchain technology that facilitates secure and private verification processes [7]. Firms like Civic and Dock provide blockchain identity management to secure data. Civic provides secure capture of an individual's own identity and prevent data abuse and unauthorized use [8]. Dock, however, provides a bank and government services identity verification blockchain system and eliminates third-party authentication risk and identity stealing [9]. In banking, TrustID (R3 Corda) has brought an identification mechanism on a blockchain platform to facilitate streamlined KYC procedures with augmented security and effectiveness in handling identity [10]. Similarly, blockchain technology is also utilized in the case of authenticating precious high-value items like diamonds through the use of Everledger to enhance secure and traceable tracking [11]. Identification verification technology with digital solutions further shows enhancement based on AI technologies. FinBTech utilizes blockchain, smart contracts, FaceNet512 face recognition, and Gaussian Mixture Models (GMM) voice verification to create an advanced identity verification system for increased financial security against identity fraud [12]. Civic and uPort also embrace more advanced blockchain-based self-sovereign models of identity. Civic enhances security by providing individuals control over identity verification processes [13]. uPort allows users to safely store authenticated credentials and manage personal information, enhancing privacy protection [14]. Overall, application of blockchain technology in banking identity verification systems is revolutionizing the industry by avoiding fraud, increasing security, and simplifying compliance. With the application of decentralized identity patterns and biometric authentication, banks can possess a best-of-breed and very secure customer authentication process.



Fig 1:Blockchain Essential Components [5]

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Fig 2: Advantages of Block chain -Bases Identity Management [5]

VI. CONCLUSION

Blockchain use in banking to verify digital identities is a step towards increased security, efficiency, and decentralization. Banks, by taking advantage of the immutability and cryptography features of blockchain, can greatly deter identity forgery, limit risks emanating from data breach, and improve Know Your Customer (KYC) regulations. Self-sovereign identity (SSI) solutions further enrich consumers by giving them mastery over their own information and facilitating frictionless authentication exchanges among banks. Blockchain-based identity proofing increased levels of consumer trust with banks through a decrease in the use of legacy intermediaries and faster onboarding. As the financial industry shifts further toward digitalization, identity management solutions based on blockchain technology are a key enabler of secure, seamless, and clear banking processes. Regulatory synchronization and interoperability will be essential in achieving large-scale adoption in the future and opening the path to a more robust and user-friendly financial system.

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