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Digital Customer Onboarding in Banking: A Systematic Review of Ekyc Technologies, Security Frameworks, And Fintech Innovations

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Abstract
The recent years have witnessed the digitalization of banking, which has changed the process of onboarding customers. Before, it used to take one to visit a bank and fill out a form or do some paperwork in order to open an account, but it is possible to do most of the work online. eKYC, artificial intelligence, blockchain, and biometric verification are some of the technologies that have accelerated and simplified this process. However, faster processes need not be associated with a pleasant experience on the part of users. Most onboarding systems are focused mostly on speed and reducing manual activities, and because of the latter, the end user of a particular process does not necessarily have a clear picture of the process. The steps can be taken by people, but they do not always realize how their information is used and processed in the background. In the paper, these types of digital onboarding methods are discussed, and it is suggested that trust is not limited to the first stage of verification. It has to develop as the users will continue using the system. The study discusses a portion of the existing issues and suggestions regarding the means of simplifying the processes of onboarding systems and making them more transparent, safe, and clear.

Keywords: *Digital Customer Onboarding; eKYC; Artificial Intelligence; Blockchain; Digital Identity; Fraud Detection; User Trust; FinTech*

1. Introduction

Customers have become more demanding and require fast and easy access to financial services with the growing use of digital banking. Onboarding process is a very important process, and it is the first interaction that the users have with the banking platforms. Previously, offloading was dependent on the physical records and verification by hand. These processes were not only time consuming but were also subject to delays and inefficiencies, and potential customers were likely to be deterred by such delays and inefficiencies in the process of registration. [7] .

In order to address these issues in a more viable manner, financial institutions have begun embracing digital onboarding to address the issues. The way that these systems are implementing eKYC, artificial intelligence and biometric authentication is that they can be done within shorter time and less manual input. Although this has seen efficiency being enhanced, it does not always sail smooth to users and in some cases it may prove confusing or unreliable. Due to this fact, it is inappropriate to concentrate on technical performance. An onboarding system would be handy and people would easily use it, not to mention that it should have the effect of making the user feel comfortable and confident as he or she enters his or her information. Meanwhile, it must also have the proper security measure and abide by the regulations.

2. Literature Review

The old manual process of customer onboarding is long gone, and it is replaced by the paperless process. It has moved towards online practices based on technologies such as e-KYC, artificial intelligence, digital identity, and blockchain. The process is now faster and more efficient, with certain problems, however. Users are still required to resubmit documents, and there have been persistent privacy and system security concerns. The primary

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application of AI is in helping to spot fraud and automate processes, whereas blockchain enables better data security and provides more control to users over their data. But the two technologies have their flaws and still have issues, particularly with regard to the aspect of transparency, scalability, and their more practical application in real-life scenarios.

Table 1 Summary of Reviewed Literature on Digital Customer Onboarding

No.	Study / Source	Methodology	Key Findings	Research Gaps / Limitations
1.	e-KYC Authentication Systems [1], [2]	Biometric and document validation identification Digital identity.	Remote onboarding is made possible, processing time and manual effort are minimized.	Data redundancy, data security issues.
2.	Frameworks of digital identity [4].	Single systems of identity that are authenticated.	Enhances safety and accessibility of services remotely.	Threat of data abuse, privacy concerns, poor long term trust.
3.	AI-based Onboarding Systems [12], [13]	Fraud detection, facial recognition, documents machine learning. s	Improves automation, preciseness and customization.	Prejudice, impossibility to explain, susceptibility to deepfakes.
4.	e-KYC Systems [4], [5] based on blockchain.]	Sovereign identity on distributed ledger.	Enhances information transparency, integrity and user control.	Scalability problems, regulatory limitations, integration problems.
5.	Conventional Onboarding Systems.	Paper work and manual checking.	Dependable and slow and resource-intensive.	Expensive, slow, inappropriate user experience.
6.	Hybrid Onboarding Models [4], [5]	Combination of AI, e-KYC, and blockchain technologies.	Offers even performance in terms of security and efficiency.	Complicated implementation, absence of standard structures.

3. Methodology

This paper is based on the systematic literature review method to examine the current studies on digital onboarding technologies. The selection of relevant studies was performed through the focus on eKYC, artificial intelligence, blockchain, and digital identity systems [3][6]. The process was structured with screening, evaluation, and selection of relevant papers, which were eventually incorporated. The chosen articles were reviewed through thematic grouping and comparative analysis with respect to efficiency, security, scalability, and user experience.

4. Key Technologies

4.1. Electronic Know Your Customer (eKYC)

eKYC allows checking the identity remotely through the use of digital records. Although it is effective, it is highly dependent on the static data which is prone to fraud [8].

4.2. Artificial Intelligence and Machine Learning.

AI aids in the detection of fraud and risk evaluation. Nevertheless, overdependence may lead to false

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positive and biasing.

4.3. Identity Systems based on blockchain.

Blockchain is more secure and transparent, although it has difficulties in scalability and integration.

4.4. Biometric Authentication

Biometrics enhance authentication and can be affected by spoofing shown in Table 2.

Table 2 Comparison of Onboarding Technologies

Technology	Speed	Security	Privacy	Scalability	Limitation
eKYC	High	Medium	Low	High	Static data
AI/ML	High	High	Medium	High	Bias
Blockchain	Medium	High	High	Medium	Integration
Biometrics	High	High	Medium	High	Spoofing

4.5. The Continuous Evaluation Model based on Trust.

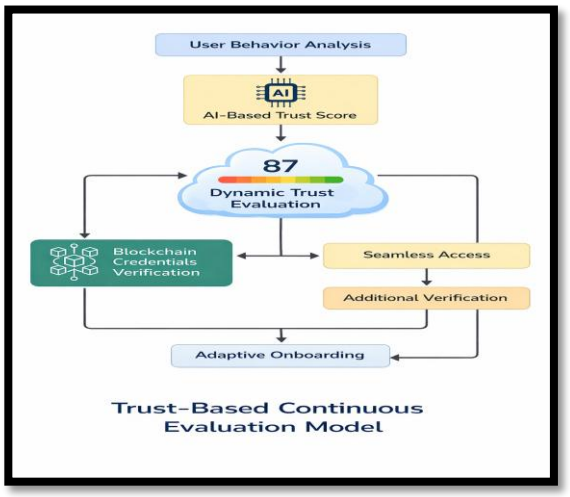

Figure 1 Proposed Trust-Based Continuous Evaluation Model

The model produces a dynamic score of trust (0-100) on the basis of behavioral data analyzed using AI, blockchain verifiable credentials, and risk indicators in real-time. A score of high allows a perfect onboarding, whereas medium and low scores provoke further verification or limited access.

The presented model will alter the one-time check onboarding into a perpetual trust assessment framework shown in Figure 1.

It integrates:

- Artificial intelligence behavioral recognition.
- Blockchain-verified credentials
- Real-time risk signals

These elements create a dynamic level of trust (0-100) of each user.

- High score - uninterrupted onboarding.
- Middle rating - further confirmation.
- Low score - restricted access

This adaptive model enhances security as well as user experience in the sense that it takes a continuous check on the trust rather than a onetime check on the verification.

5. Results and Discussion

Through the analysis, it is found that digital onboarding has changed significantly with the changes in technology, yet it continues to experience several weaknesses like verifying the same person and the concern of privacy. Artificial intelligence enhances the detection of fraud and automation, but presents such challenges as prejudice and absence of transparency. The systems based on blockchain improve its security and control over data, but have issues related to scalability and government regulations. The technological comparison reveals that no technology is able to address all the issues completely. A combination of AI, blockchain, and digital identity systems tends to produce improved outcomes since it strikes a balance between efficiency and security. Meanwhile, the question of user trust remains a large concern. Not all automation-centered systems are comfortable and easy to use. Due to this reason, trust should not be verified only once during the onboarding process. It must be checked continuously in order to make users feel more confident in the process [10-15].

6. Future Research Directions

The future of digital onboarding can be narrowed down to several aspects. Developing AI-based fraud detection models based on real-time hybrid models is

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one of the key areas. The other is developing decentralized identity using SSI and verifiable credentials to ensure users can be more in control of their data. It is also necessary to ensure KYC verification is more secure, through encryption by blockchain and privacy methods like zero-knowledge proofs. Concurrently, the authentication systems must be structured in such a manner that their privacy is not compromised and yet they comply with regulations such as GDPR and PSD2. Finally, the banks are expected to be capable of exchanging identity information safely with standard common standards, like eIDAS, which will simplify the onboarding process.

Conclusion

EKYC, artificial intelligence, blockchain, and biometrics are some of the technologies that are changing the current process of customer onboarding into banks. All this has been made easier and fast and people are now able to access financial services without having to walk into a branch. Nonetheless, it has all these improvements and still one can point to some areas that are still not being improved, especially as far as user trust, privacy, and ease of use is concerned. According to the review, it is clear that most of the systems are more about speed and automation than the comfort and ease of the process to the user. The AI and eKYC undoubtedly made the verification process much easier, but it is also linked to such challenges as bias, lack of transparency, and even the presence of sophisticated fraud. Conversely, blockchain helps to improve security; however, it also has its drawbacks, especially regarding its scales and in how far it can be applied to actual life scenarios. Overall, it seems that the concept of digital onboarding cannot be boiled down to technology. It should also possess a trade-off between efficiency and building user trust. The future systems must be more concerned about the continuous check of trust and the integration of different approaches that will make the process more secure, reliable and comfortable.

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