

A Study on Biometric Authentication in Banking Trends and Security Analysis with Special Reference to Tirunelveli City

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Abstract: *The banking sector has undergone a remarkable transformation in recent decades due to rapid technological advancements and digitalization. As financial institutions focus on security, efficiency, and inclusion, biometric authentication has emerged as a reliable and innovative method for verifying customer identity. Unlike traditional systems that rely on passwords, PINs, or tokens, biometric authentication uses unique physiological and behavioral traits such as fingerprints, facial recognition, and iris scans to provide a higher level of accuracy and protection. In India, the introduction of Aadhaar-based biometric authentication by the Unique Identification Authority of India (UIDAI) has been a major step toward strengthening digital banking infrastructure and ensuring secure financial access for all citizens. This system has enhanced convenience while reducing risks of fraud and identity theft. The present study, titled “A Study on Biometric Authentication Recent Trends and Analysis with Special Reference to Tirunelveli City,” examines the level of adoption, awareness, and effectiveness of biometric authentication in the banking sector. The main objectives of the study the current trends in the adoption of biometric authentication in the banking sector with special reference to Tirunelveli city and to examine customer awareness and perception towards biometric authentication as a secure mode of banking. The research specifically focuses on customers and staff members of selected public, private, and co-operative banks in Tirunelveli City. It explores users’ perceptions of security, ease of use, reliability, and satisfaction, while also identifying the challenges and barriers banks face in implementing these technologies. The study adopts a descriptive research design, using both primary and secondary data. Primary data were gathered from 136 respondents through structured questionnaires, most of which utilized a five-point Likert scale to measure satisfaction levels. Secondary data were collected from journals, articles, books, and official websites. The analysis employed statistical tools such as Percentage Analysis, Likert Scale, and Garrett Ranking to interpret responses effectively. Overall, the study aims to highlight the growing significance of biometric authentication in promoting secure, user-friendly, and efficient banking operations. It also provides insights for policymakers, banks, and technology providers to enhance digital security frameworks, strengthen customer trust, and encourage broader adoption of biometric technologies, especially in semi-urban regions like Tirunelveli.*

Keywords: Biometric Authentication, Digital Banking, Security, Convenience, Fingerprint Recognition, Financial Inclusion

I. INTRODUCTION

The banking sector has undergone a remarkable transformation in the past two decades, largely driven by rapid advancements in information and communication technologies. Traditionally, banking operations relied on manual processes and physical verification methods, which often led to inefficiencies, delays, and security vulnerabilities. With the rise of digital banking and financial inclusion initiatives, there has been a pressing need for more secure, reliable, and



user-friendly authentication systems. In this context, biometric authentication has emerged as a groundbreaking innovation that ensures both convenience and robust security for customers. Biometric authentication involves verifying an individual's identity based on unique physiological and behavioral traits such as fingerprints, iris patterns, facial features, and voice recognition. Unlike conventional authentication methods like passwords, PINs, or tokens, biometric systems are difficult to forge or replicate, thereby significantly reducing the risk of identity theft, fraudulent transactions, and unauthorized access. In India, the introduction of Aadhaar-based biometric identification by the Unique Identification Authority of India (UIDAI) has further accelerated the adoption of biometric systems in banking, enabling millions of citizens to access financial services securely and efficiently. In the present era of digital payments and a cashless economy, biometric authentication plays a vital role in enhancing customer trust and promoting financial inclusion, particularly in semi-urban and rural regions. Tirunelveli city, being a fast-growing urban center with diverse socio-economic backgrounds, offers a significant case for studying the adoption and effectiveness of biometric authentication in banking. The increasing reliance on Aadhaar-enabled Payment Systems (AePS), biometric ATMs, mobile banking, and internet-based financial services highlights the need to evaluate customer awareness, acceptance levels, and security concerns in this region.

1.1 STATEMENT OF THE PROBLEM:

The rapid digitalization of the banking sector has brought forward biometric authentication as a secure and efficient alternative to traditional methods like PINs, passwords, and tokens. By using unique physiological traits such as fingerprints, iris scans, and facial recognition, biometric systems aim to reduce fraud, identity theft, and unauthorized access. However, despite its growing adoption, biometric authentication is still surrounded by challenges that hinder its effectiveness and acceptance among customers. In India, Aadhaar-based biometric authentication has been a major driver of financial inclusion, but issues such as data privacy concerns, lack of awareness, technological glitches, and implementation costs create barriers to widespread trust and usage.

1.2 OBJECTIVES OF THE STUDY:

To study the current trends in the adoption of biometric authentication in the banking sector with special reference to Tirunelveli city.

To examine customer awareness and perception towards biometric authentication as a secure mode of banking.

To analyze the security benefits of biometric authentication in reducing fraud, identity theft, and unauthorized access in banking transactions.

To identify the challenges and limitations faced by banks and customers in the implementation of biometric authentication systems.

II. REVIEW OF LITERATURE

V Shacheendran, et al. (2025) entitled a research on the topic “A Study on International Journal of Economics and Financial Issues” 15 (1), 295, 2025. The study reviews Open Banking research from 1999 to 2024 using Scopus data with Biblioshiny and Citespace. Findings show a sharp rise in publications after 2018, driven by regulations like PSD2, with the UK, India, and China leading contributions. Research themes such as data sharing, fintech, and API regulation are well-developed, while critical areas like API security and risk management remain underexplored. Collaboration networks reveal strong ties between countries and authors, and clusters highlight links to technologies like machine learning and blockchain. The review stresses the need for stronger API security frameworks and better integration of advanced technologies with regulatory compliance.

P Mathivanan, et al. (2024) the report is referred to as “A Study on AI Based Biometric Systems in Financial Transactions: Case Study,” Biometric authentication is transforming the financial services industry by offering a secure and user-friendly alternative to traditional verification methods. It uses unique traits like fingerprints, facial recognition, voice, and behavioral patterns to confirm identity. With AI advancements, processes like enrollment, verification, and fraud detection are becoming more accurate and efficient. The benefits include enhanced security, reduced fraud,



improved customer experience, and regulatory compliance. However, concerns like deep fake attacks remain, making strong security measures essential. Overall, biometrics in finance shows great promise for safer and more convenient transactions.

Pandey (2022) entitled a research on the topic “A Study on Digital Payment System and Consumer Perception”. This study looks at how digital payments in India have changed before and after the COVID-19 pandemic. It explains the different payment methods used in banks, like UPI, mobile wallets, internet banking, and cards. People choose how to pay based on trust, ease of use, and past experiences with online fraud. The use of digital payments is expected to grow as people's income, education, and access to technology improve. The main objective of this study is to analyze the growth and changes in the digital payment system of India, especially before and after the COVID-19 pandemic. It aims to understand the various modes of digital payments used in the Indian banking sector, such as UPI, mobile wallets, net banking, and cards.

III. RESEARCH METHODOLOGY

The research focuses on customers and staff members of selected public, private, and co-operative banks within Tirunelveli City. The study investigates customer perception regarding security, ease of use, reliability, and satisfaction levels, while also identifying the challenges and limitations faced by banks in implementing biometric systems. Research Methodology that study follows a descriptive research design. Data were collected using structured questionnaires, with most questions based on a five-point Likert scale to assess respondents' level of satisfaction. Both primary and secondary data sources were utilized. Primary data were collected directly from 136 respondents in Tirunelveli City through questionnaire distribution, while secondary data were obtained from journals, articles, books, newspapers, magazines, and official websites.

IV. TOOLS FOR ANALYSIS

Apart from the necessary tables, charts, suitable statistical tools are applied for analysis and interpretation of data.

Percentage Analysis.

Likert Scale

Garrett Ranking

V. ANALYSIS AND INTERPERTETIONS:

ACCOUNT WISE CLASSIFICATION:

Bank accounts are the basic financial tools used by individuals for saving, transaction, and business purposes. The two common account types are *savings* and *current accounts*, while some respondents maintain both for convenience.

ACCOUNT WISE CLASIFICATION

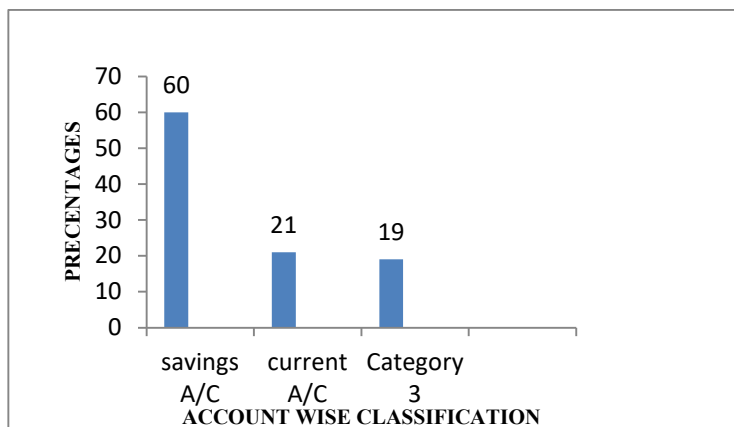
SI. No	Type of the Account	No. of Respondents	Percentage
1	Savings account	82	60
2	Current Account	28	21
3	Both	26	19
	TOTAL	136	100

Source: primary data

INTERPETETION:

From the above table 1.6.1 indicate that a majority, 60 percentage of the respondents hold savings account, suggesting a strong preference for personal banking and everyday financial management. Current accounts are held by 21 percentage of the respondents, reflecting their use for business or professional transactions. Additionally, 19 percentage of respondents maintain both savings and current accounts, indicating a need for diversified banking services to manage both personal and business finances. Overall, the data highlights that while savings accounts are the most common, a significant portion of users engage with multiple account types to meet varied financial needs.





OPINION TOWARDS BIOMETRIC AUTHENTICATION DRAWBACKS:

S.NO	STATEMENT	SDA	DA	NO	A	SA	MEAN SCORE	RANK
1.	Lack of control over data usage	8 (40)	15 (60)	18 (54)	50 (100)	45 (45)	299	V
2.	Privacy concerns over biometric data	10 (50)	18 (72)	20 (60)	48 (96)	40 (40)	318	IV
3.	High setup or implementation cost	12 (60)	20 (80)	25 (75)	45 (90)	34 (34)	339	I
4.	Possibility of system errors/failures	11 (55)	22 (88)	21 (63)	47 (94)	35 (35)	335	II
5.	Not suitable in all physical conditions	9 (54)	19 (76)	23 (69)	49 (98)	36 (36)	333	III

Source: Primary data

INTERPETETION:

From the above table 1.6.2 shows that respondents recognize several drawbacks of biometric authentication in banking. The highest mean score indicates that many believe the high setup or implementation cost is the major drawback of using biometric systems. This shows that cost remains a key concern for both banks and customers. The next important drawback is the possibility of system errors or failures, suggesting that users have faced or fear about technical problems during authentication. The third-ranked issue, unsuitability in all physical conditions, means some users think biometrics may not work properly for everyone, such as when fingerprints or facial features change due to injuries or aging. Concerns about privacy and data usage are also noted, though they rank lower, showing that while users worry about how their biometric data is used, it is not their top concern. Overall, the findings suggest that while biometric systems are widely accepted, people still worry about their cost, reliability, and limited adaptability in certain situations.

FINDINGS:

According to the occupational wise classification the majority 37 percentage of respondents are employed, proving that working individuals are the major users of biometric banking services.

According to the account wise classification the majority 60 percentage of respondents have savings accounts, suggesting personal and regular banking as the key area of biometric use.

According to the aware of biometric authentication the majority 84 percentage of respondents are, indicating a high level of awareness in Tirunelveli city.



SUGGESTIONS:

Multi-factor authentication (biometric + OTP) should be made mandatory for high-value transactions.
Training programs for bank staff should be enhanced, as they are the primary source of customer awareness.
Banks should provide easy technical support for users facing biometric login issues.
Mobile banking apps should integrate secure and user-friendly biometric options for convenience.

VI. CONCLUSION

Biometric authentication has become a vital innovation in modern banking, offering enhanced security, accuracy, and convenience compared to traditional methods such as passwords or PINs. By using unique biological traits like fingerprints, facial features, and iris patterns, it provides a more reliable way to verify customer identity and prevent fraud.. Introducing multi-factor authentication (biometric combined with OTP or PIN) can further enhance safety, especially for high-value transactions. In conclusion, biometric authentication is transforming the banking sector by making financial transactions faster, safer, and more user-friendly. The technological improvements and proper regulatory frameworks, it can greatly contribute to creating a secure and digitally empowered banking environment, particularly in emerging regions like Tirunelveli City.

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