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The Evolution of Banking Technology and Its Influence on Customer Behavior in Virudhunagar District

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Abstract

This study examines the evolution of banking technology and its impact on customer behavior within the Virudhunagar district, a region characterized by a transitional economy where traditional practices and industrial modernization coexist. The research traces the progression of banking technologies, from the introduction of ATMs in the late 1960s to the development of Core Banking Systems (CBS) in the 1970s and 1980s, and the more recent advent of Internet Banking and the Unified Payments Interface (UPI). It investigates how this technological evolution has influenced customer preferences and adoption patterns, moving from a reliance on traditional, face-to-face interactions to the growing popularity of digital platforms. The study highlights the challenges in this transition, including disparities in digital literacy and internet connectivity between urban and rural areas. It also addresses customer apprehensions regarding security, privacy, and the complexities of online transactions. By analyzing these factors, this research aims to provide insights into how banks can better facilitate a seamless and trustworthy digital banking environment that caters to a diverse customer base.

Keywords: banking technology, customer behavior, transitional economy, digital literacy, Virudhunagar district, financial inclusion, online banking, UPI

Introduction

The Virudhunagar district offers a compelling case study in the evolving landscape of financial services in India. It represents a transitional economy where traditional banking practices coexist with the rapid onset of industrial modernization. This unique blend makes the district an ideal setting for examining the influence of digital transformation on consumer behavior within the banking sector. Nationally, the banking sector has experienced significant technological evolution—starting from the introduction of Automated Teller Machines (ATMs) in the late 1960s, followed by the adoption of Core Banking Systems (CBS) in the 1970s and 1980s, and more recently, the integration of Internet Banking and the Unified Payments Interface (UPI). These advancements have significantly reshaped customer interaction with banks, gradually shifting preferences from conventional branch-based services to digital platforms.

Statement of the Problem

Despite the nationwide momentum toward digital banking, the transition within Virudhunagar district remains uneven, particularly due to its mix of urban and rural populations. While technological advancements offer enhanced convenience and efficiency, several challenges persist. These include

significant gaps in digital literacy, inconsistent internet connectivity in rural areas, and enduring customer concerns regarding online security, data privacy, and the complexity of digital banking processes. These barriers hinder the full adoption and utilization of modern banking technologies. There is a pressing need to understand how these factors influence customer preferences and what strategies banks can employ to overcome them, especially in regions like Virudhunagar with unique socio-economic characteristics.

Review of Related Literature

Alshehadeh *et al.* (2023) examined the impact of financial technology on customer behavior in Jordanian commercial banks using a descriptive research design and data from 300 randomly selected administrative employees. Analysis through SPSS showed a significant positive effect of financial technology—covering credit services, payment services, investment management, and financial market support—explaining 84.1% of the variance in customer behavior. The authors emphasized that rapid adaptation to financial innovations enhances customer loyalty and satisfaction. They recommended that Jordanian banks embrace digital transformation to remain competitive and encouraged further research on financial technology due to the limited literature on the topic..[1]

Zaber, Z. (2024). examined the impact of digital banking on consumer behavior, highlighting shifts in preferences, attitudes, and decision-making patterns resulting from the rise of online and mobile banking. The study noted that integrating digital technologies into modern banking has transformed financial interactions and reshaped the industry's landscape in the digital age.[2]

According to Madhumita et al. (2024), the banking sector has undergone a revolution due to digital transformation, which has improved customer experiences and operational efficiency. They emphasized how real-time analysis of consumer behavior is made possible by the convergence of artificial intelligence (AI) and the Internet of Things (IoT), using data from connected devices like wearables and smartphones. IoT makes it easier to gather a variety of data points, such as location, transaction history, and device interactions, resulting in a thorough digital footprint. These data, when combined with AI algorithms, give banks a more accurate way to spot patterns in behavior. Secure transmission protocols, AI-driven analytics engines, and IoT-based data acquisition are important elements of this integration.[3]

Scope of the Study

This research is confined to an analysis of the evolution of banking technology and its influence on customer behavior within the Virudhunagar district, a region selected for its unique blend of traditional practices and industrial modernization. The study examines the adoption and impact of key technologies, including ATMs, Core Banking Systems (CBS), Internet Banking, and the Unified Payments Interface (UPI). It investigates customer preferences, adoption patterns, and the factors that drive or hinder the transition to digital platforms, covering demographic influences, digital literacy challenges, and customer apprehensions related to security and privacy. While the research traces the historical progression of these technologies from the late 1960s, its primary focus is on the current landscape of adoption. The findings and recommendations are limited to the context of customer behavior and engagement within this specific district and do not extend to a national-level

[1] Alshehadeh, A. R., Al-Khawaja, H. A., Yamin, I. S. M. A. I. L., & Jebril, I. Q. B. A. L. (2023). The impact of financial technology on customer behavior in the Jordanian commercial banks. *WSEAS Transactions on Business and Economics*, *20*, 2263-2275.

[2] Zaber, Z. (2024). The Evolution of Consumer Behavior in the Era of Digital Banking. *International Journal of Economics & Business Administration (IJEBA)*, *12*(3), 178-186.

[3] Madhumita, G., Das, T., Das, S., Khatri, E., Ravisankar, P., & Hemachandu, P. (2024, April). IoT and AI for real-time customer behavior analysis in digital banking. In *2024 5th International Conference on Recent Trends in Computer Science and Technology (ICRTCST)* (pp. 198-203). IEEE.

analysis or the financial performance of individual banks.

Objectives of the Study

1. To examine the influence of evolving banking technologies on customer behavior in Virudhunagar district.
2. To identify the demographic, technological, and service-related factors that drives the adoption and satisfaction of online banking services.

Research Methodology

The study adopted a quantitative research design to assess the impact of banking technology on customer behavior in the Virudhunagar district. Data were collected through structured surveys administered to 120 respondents, covering adoption rates, demographic influences, and satisfaction with various online banking services. Although the specific sampling method was not explicitly stated, the selection included participants from diverse demographic backgrounds such as different age groups, education levels, income categories, and urban/rural residences ensuring a broad representation of customer segments.

Statistical analysis was performed using SPSS, employing tools such as ANOVA and t-tests to examine demographic influences (with significance at *p* < 0.05), and factor analysis (validated through KMO and Bartlett's tests) to identify underlying factors influencing satisfaction and adoption.

Current Landscape of Online Banking Service Adoption in Virudhunagar

The table presents a summary of the adoption rates for various online banking services in Virudhunagar, based on a survey of 120 respondents. The data is represented in 'Converted Points', which reflect the extent of use for each service, with a higher score indicating greater adoption. The services are also ranked from 1 to 18, with rank 1 being the most used service.

Table No. 1 Extent of use for various online banking services

S.No	Online Banking Services	Converted Points (120 respondents)	Rank
1	Funds transfer	362	1
2	Mobile / DTH recharging	357	2
3	Real Time Gross Settlement (RTGS)	355	3
4	Online trading service	354	4
5	Electronic Clearance Service (ECS)	351	5
6	View account statements	351	6
7	Online share trading services	351	7
8	Tax Deducted at Source enquiry	349	8
9	Deposit by using ATM	348	9
10	Request for cheque book	347	10
11	Enquiry about cheque collection	345	11
12	Request for Demand Draft	345	12
13	Withdrawal by using ATM	344	13
14	E-locker facility	343	14
15	Ticket Booking	340	15
16	Payment of utility bills	339	16
17	Demate A/c operation	335	17
18	Payment of taxes	322	18

Source: Primary data

Based on the table, the adoption of online banking services in Virudhunagar shows a strong preference for high-frequency, routine financial tasks, while more specialized or less frequent services have a lower usage rate. The most popular services, such as "Funds transfer" (362 points) and "Mobile / DTH recharging" (357 points), highlight

that convenience and immediate transactional utility are key drivers for customer engagement. Conversely, services like "Payment of taxes" (322 points) and "Demate A/c operation" (335 points) are the least utilized, suggesting a potential gap in customer awareness, perceived complexity, or trust for services that are less common or require greater financial literacy.

Demographic Influences on Online Banking Usage

This analysis examines the impact of various demographic factors—including age, education, occupation, bank type, account type, income, residence, and marital status—on the usage of online banking services. Utilizing statistical tests like ANOVA and t-tests, the study identifies which services show statistically significant differences in adoption across different demographic groups, with a p-value of less than 0.05 indicating a significant influence. The following table summarizes these key findings.

Table No. 2 Significant demographic influences on online banking service usage:

Demographic Factor	Services with Statistically Significant Differences (p-value < 0.05)	p-value
Age Group	View Account Statement, Demate A/C Operation, Electronic Clearance Service (ECS)	0.003, 0.042, 0.019
Education	Online Trading Service, Deposit by Using ATM, Request for Demand Draft	0.047, 0.023, 0.034
Occupation	Ticket Booking, Enquiry About Cheque Collection	0.047, 0.041
Type of Bank	Enquiry About Cheque Collection, Tax Deducted at Source Enquiry	0.012, 0.029
Type of Account	Funds Transfer, Deposit by Using ATM	0.003, 0.046
Income	Mobile/DTH Recharging, Enquiry About Cheque Collection, E-locker Facility	0.038, 0.017, 0.029
Residence	Request for Demand Draft, Tax Deducted at Source Enquiry	0.018
Marital Status	Deposit by Using ATM, Electronic Clearance Service	0.029, 0.001

Source: Primary data

The analysis reveals that while the most frequently used, high-utility services like "Funds Transfer" and "Mobile/DTH Recharging" have achieved broad adoption that is largely independent of demographic variations, more specialized services show a clear dependency on specific customer characteristics. Age and education are significant factors influencing the adoption of services requiring higher digital or financial literacy. For instance, age significantly impacts the use of "View Account Statement" and "Demate A/C Operation," while education influences the adoption of "Online Trading Service" and "Request for Demand Draft." This suggests that the barrier to deeper digital integration is not just a matter of access, but also of a customer's capability and understanding of more complex financial activities.

Furthermore, factors like occupation, bank type, income, residence, and marital status significantly affect the usage of services that often involve the digitization of traditional banking processes, such as "Enquiry About Cheque Collection" and "Tax Deducted at Source Enquiry." This indicates a nuanced relationship between trust, familiarity, and a customer's background. The varying usage patterns for these services suggest that for traditional processes to be successfully digitized, banks may need to build explicit trust and offer simplified guidance, as the familiarity with these digital processes is not uniform across all customer segments. Overall, the findings highlight a two-tiered adoption landscape: a universally accepted core of simple, convenient services, and a more demographically sensitive sphere of complex, specialized offerings.

Factors Determining Customer Satisfaction with Online Banking Services

Table No.3 Factors Determining Customer Satisfaction with Online Banking Services

Factor Name	Eigen Value	% of Variance Explained	Associated Variables (Factor Loading)	Cronbach's Alpha
Utility Bill Payments and ATM Withdrawals	1.831	9.635%	Payments of utility bills (0.673), Withdrawal by using ATM (0.568), E-locker (0.503)	0.761
Account Information and Services	1.688	8.882%	Enquiry about cheque collection (0.616), Mobile/DTH recharging (0.583), Ticket booking (0.582), Request for cheque book (0.529), View account statements (0.497)	0.826
Demand Drafts	1.539	8.098%	Request for demand draft (0.738)	0.823
Electronic Clearance Services	1.421	7.479%	Electronic clearance service (0.699), Real time gross settlement (0.530)	0.702
Tax-Related Services and Online Trading	1.142	6.010%	Tax deducted at source enquiry (0.548), Online trading service (0.510), Stop payment request (0.503)	0.734
Payment of Taxes and Online Shopping	1.127	5.932%	Payment of taxes (0.586), Online shopping (-0.465)	0.842
Online Share Trading and Funds Transfer	1.091	5.740%	Online share trading service (0.603), Funds transfer (-0.534)	0.752
Demat Account Operations	1.001	5.270%	Demate A/C operation (0.770)	0.614

Source: Primary data

The factor analysis reveals that customer satisfaction with online banking is not driven by individual services in isolation but rather by the cohesive performance of groups of related services. Services are clustered into logical factors, such as Utility Bill Payments and ATM Withdrawals (Factor 1) and Account Information and Services (Factor 2), which indicates that customers evaluate their experience based on the seamless functioning of these connected ecosystems. This suggests that banks

should focus on a holistic service design, ensuring integration and reliability across functionally related offerings to enhance overall satisfaction.

A particularly noteworthy finding is the negative factor loadings for Online Shopping and Funds Transfer, services that are among the most highly used. Despite their frequent usage, their negative association with satisfaction suggests that customers may have underlying dissatisfiers or unmet expectations. For Online Shopping, this could be due to issues beyond the bank's control, such as merchant or delivery problems, which still negatively impact the customer's overall experience. For Funds Transfer, it could point to pain points related to transfer speed, limits, or interface complexity. This highlights a critical insight for banks: high usage does not automatically equate to high satisfaction. To improve customer experience and loyalty, banks must investigate and address these specific friction points within their most popular services.

Key Influencers of Online Banking Service Adoption and Usage

A factor analysis was conducted to pinpoint the key factors that influence the adoption and sustained usage of online banking services. The analysis confirmed the data's suitability and extracted nine distinct factors, each with an Eigen value above one, which collectively explain over 60% of the variance in the factors determining usage. These factors provide a comprehensive view of the underlying drivers that motivate customers to use digital banking platforms.

Table No. 3 Key factors Influencing Online Banking Service Usage

Factor Name	Eigen Value	% of Variance Explained	Associated Variables (Factor Loading)	Cronbach's Alpha
Promptness and Efficiency	3.509	15.258%	Webpage maintenance (0.894), Relevance of information (0.887), Securing username in online transaction (0.887), Reduced chances of internet fraud (0.587), Intention towards online banking (0.577), Quickness in completion (0.498)	0.661
Information Security and Customer Support	1.751	7.614%	Real-time information (0.638), Internet connectivity (0.596), Alert on phishing attacks (-0.572)	0.873
Transaction Reliability and Cost	1.470	6.392%	Establishment of privacy in online transaction (0.582), Usefulness of information system (0.512), Dimension of service quality (0.498)	0.610
Trust and Privacy in Online Transactions	1.388	6.037%	Promptness in error recovery (0.503)	0.837
Information Quality and Relevance	1.305	5.675%	Ensuring trust online transaction (0.526)	0.742
Real-time Information and Internet Connectivity	1.232	5.355%	Easiness of doing transaction (0.523), Provision of guidance (-0.476)	0.793

Online Banking Adoption and Security	1.136	4.938%	Information of right level of details (-0.480), Cost of transaction (0.428)	0.682
Website Maintenance and User Experience	1.096	4.764%	Protection of customer information (-0.540), Support by server (-0.516)	0.774
Overall Service Quality	1.075	4.673%	Protection of customer information (0.581), Support by server (-0.579), 24x7 servicing (-0.469)	0.722
Source: Adapted from Tables 5.20-5.31				

Source: Primary data

The analysis reveals that the adoption and usage of online banking services are primarily driven by a customer's perception of the platform's efficiency, security, and reliability. Promptness and Efficiency emerged as the most dominant factor, explaining over 15% of the variance, and encompasses critical variables like webpage maintenance, information relevance, security, and quickness. This underscores that users are motivated by the clear time-saving and safety benefits of digital banking. This is further reinforced by other factors like Information Security and Customer Support, and Transaction Reliability and Cost, which collectively emphasize the importance of trust, privacy, and accessible, accurate information.

A notable finding is the presence of negative factor loadings for seemingly positive variables such as "alert on phishing attacks," "provision of guidance," "protection of customer information," and "24x7 servicing" within their respective factors. This suggests that while these are fundamentally important for security and usability, customers may view them as baseline expectations, or "hygiene factors," whose absence or failure is a significant deterrent to usage. Their mere presence might not be a strong motivator for adoption, but their ineffectiveness is a major red flag that erodes trust. This indicates that banks must not only provide these features but also ensure they are robust, reliable, and proactively communicated to build and maintain user confidence. Therefore, for sustained digital engagement, banks must invest in a robust technical infrastructure, continuous user education, and responsive, always-available support, as these are foundational to a positive user experience and lasting trust.

Challenges and Implications for Digital Banking Adoption

Digital Literacy: A significant gap in digital literacy exists, as the use of complex services like "Online Trading Service" and "Demate A/C Operation" is heavily influenced by a user's age and education. This shows that adoption beyond basic transactions requires foundational digital and financial understanding.

Internet Connectivity: Reliable internet connectivity is a critical component of perceived service quality and trustworthiness. Inconsistent connectivity can directly undermine user confidence, making it a key influencer of sustained usage.

Security and Privacy: Customer apprehensions are a major barrier. Security is a foundational expectation, not a mere feature. The study found that perceived failures in security measures, such as "protection of customer information" and "phishing attack alerts," are powerful deterrents to usage.

Transaction Complexity: The perceived complexity of online transactions is a significant obstacle. For transactions to be widely adopted, they

must be intuitive and easy to use, with clear guidance provided to the user.

The "Digital Comfort Zone": While high-frequency services like "Funds Transfer" are widely used, more complex services are not. This indicates a "digital comfort zone" where users are willing to engage, and moving beyond it requires banks to address specific barriers related to literacy, perceived risk, and clear value propositions for less-frequent services.

Recommendations for Fostering a Seamless and Trustworthy Digital Banking Environment

Based on the comprehensive analysis of online banking adoption, customer behavior, and influencing factors in the Virudhunagar district, the following recommendations are put forth to facilitate a more seamless and trustworthy digital banking environment:

- Develop and implement targeted digital literacy programs, with a particular focus on older age groups and residents in rural areas. These programs should concentrate on fundamental functionalities such as "View Account Statement" and general navigation of online banking interfaces.
- Simplify user interfaces for more complex services, including Demat A/C operations and tax enquiries. Incorporate in-app guidance, step-by-step tutorials, and contextual help to reduce perceived complexity.
- Offer multi-lingual support within digital platforms and ensure that all explanations and instructions are clear, concise, and free of technical jargon to cater to a diverse customer base.
- Implement and continuously upgrade advanced security features, and critically, communicate these measures transparently to customers. Regular updates on security enhancements can build confidence.
- Provide clear, proactive alerts on potential phishing attempts and conduct ongoing educational campaigns to empower users in identifying and avoiding online fraud.
- Ensure robust data privacy protocols are in place and consistently communicate how customer information is protected, reinforcing the bank's commitment to privacy.
- Prioritize "promptness in error recovery" as a core operational objective. Efficient and swift resolution of issues is a powerful mechanism for building and maintaining customer trust.
- Prioritize investments in stable internet connectivity and reliable server support. These are not merely technical requirements but are critical components of perceived service quality and a positive user experience.
- Strengthen 24/7 customer support channels to ensure that queries and issues are addressed promptly and effectively. Consistent and accessible support reinforces trust and reliability, especially for users navigating new digital terrains.

Conclusion

The evolution of banking in Virudhunagar shows a dual pattern of adoption. While core transactional services like funds transfer have widespread usage, engagement with more complex services is still limited. Usage of these more advanced offerings is significantly influenced by demographics, particularly age and education. The analysis identifies efficiency, security, and trust as primary drivers for digital banking adoption and customer satisfaction. However, persistent challenges like digital literacy gaps, inconsistent internet connectivity, and security apprehensions continue to impede broader engagement. To foster deeper adoption, banks must prioritize a customer-centric approach. This involves investing in robust security and simplifying user interfaces. Targeted digital literacy programs are also essential. Ultimately, this strategy will build a truly inclusive and trustworthy digital banking environment.

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