

Research Paper



## Customer satisfaction in ai-enabled banking: the roles of preferred banking mode and digital literacy

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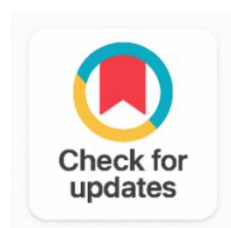
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### ABSTRACT

The speedy adoption and integration of Artificial Intelligence (AI) in banking operations and services through platforms like chatbots, mobile banking, and intelligent ATMs have extensively revolutionized customer interactions and banking operations. Although current literature explores the efficiency and customization advantages of Artificial Intelligence in banking operations and services, few studies investigate the main and interaction effects of customer satisfaction through preferred banking mode and digital literacy, especially in developing countries such as India. Focusing on this research gap, the study analyzes the main and interaction effects of Preferred Banking Mode (digital, hybrid, and traditional) and Digital Literacy (low, moderate, and high) on customer satisfaction in the context of AI-enabled banking services. A quantitative, cross-sectional research approach is adopted using a structured questionnaire administered to 390 banking customers in Bangalore. Customer satisfaction is measured using a reliable multi-item Likert scale ( $\alpha = 0.915$ ), and data is analyzed using two-way ANOVA. The results reveal significant main and interaction effects, with higher satisfaction among digitally literate customers using digital banking.

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## 1. INTRODUCTION

The banking industry has witnessed a rapid digital transformation due to the use of artificial intelligence technologies like chatbots, robo-advisors, intelligent ATMs, and mobile banking apps etc. [1] [2]. Such tools provide better levels of personalization, increased efficiencies, and convenience for customers, thereby completely changing the way customers experience banking services [3]. Research studies from across the world confirm the notion that artificial intelligence tools significantly increase the speed, authenticity, and attraction of customers [4]. Yet satisfaction levels remain varying according to the level of customers' choices for services, whether traditional or online and hybrid [5], [6].

Recent research has begun to shift its focus from the operational advantages and has started to concentrate on the perceptions of customers regarding the usage of artificial intelligence in banking services. It has been found that customers usually develop positive perceptions towards AI-based banking services when the services are user-friendly, reliable, and of obvious benefit to them [7], [8]. The level of AI adoption also varies noticeably between public and private sector banks, which influences customer expectations and confidence in digital banking services [9]. While private sector banks are often viewed as more agile and technologically advanced, public sector banks continue to face issues related to digital awareness, infrastructural readiness, and customer adaptation [10], [11]. In addition to this, the issue of data privacy, trust, and transparency in AI systems is an important factor in influencing customer attitudes towards AI-based banking services [12]. Customers have the positive attitudes towards these technologies, resulting in increased satisfaction, loyalty, and adoption of AI-based banking services.

### Problem Statement and Research Gap

Despite the growing body of evidence on the benefits of using AI, limitations also include empathy deficits, lack of clarity on the transparent use of data, and different rates of adoption in different social strata [13], [14]. The existing body of knowledge typically studies the adoption rates of AI and customer satisfaction in silos. The interaction between preferred service delivery channels and digital literacy is ignored in existing knowledge. For example, although highly digital-savvy customers may be satisfied with those serviced by AI-based digital channels, customers in low literacy social categories might be satisfied with offline/hybrid banking channels [15].

### Objectives and Hypotheses

The study aims to assess the impact of preferred banking mode and digital literacy influence customer satisfaction in AI-enabled banking. Specifically, it tests:

- **H1:** There is a significant main effect of preferred banking mode on banking satisfaction.
- **H2:** There is a significant main effect of digital literacy on banking satisfaction.
- **H3:** There is a significant interaction effect between preferred banking mode and digital literacy on banking satisfaction.

### Significance of the Study

This research has its applications in improving current theories and literature related to customer satisfaction involving service modes, and it bridges the limitation of previous research related to AI and banking [1], [3]. Moreover, it would help banks in such countries like India formulate appropriate strategy paths that address both the efficiency of AI and the emotional element of human connection, adapting according to the customer's level of digital literacy, which aligns with having equity-focused and customer-centric innovations for the banking industry [16].

## 2. RELATED WORK

The expanding use of artificial intelligence (AI) technology in financial services has raised an increasing number of academic inquiries regarding its effects and outcomes concerning consumer satisfaction, service quality, and loyalty. [1], [17], [18] began such academic explorations within India, showing that AI-based services such as smart ATMs and mobile applications increase accessibility and trust, although their study also indicated a research gap concerning demographic differences in terms of outcomes related to loyalty. Continuing such explorations, [3] validated through a quantitative study that AI technology improves time-saving and efficiency within banking services, but also indicated a preference for human involvement, possibly to create a combination of AI and human-based services to sustain greater levels of satisfaction. Extending the perspective to the generational level [4] further supported the point that the factor which shapes millennial satisfaction in the Philippines is responsiveness and reliability, although service downtime sensitivity firmly places the emphasis on the requirement to personalize services in the digital world. Contemporaneous research in Sri Lanka [19] shows similar evidence, having found chatbots to be beneficial to efficiency and availability, yet inferior to human customer service in terms of empathy and assurances, thereby firmly emphasizing service mode preference.

In Europe [13] reiterated that reliability and perception strongly predict levels of satisfaction in Hungary, but demographic moderators like age and gender were deemed small, hinting at a universal need for reliable services. Further [6] explored China's CBDC pilot projects, stating that AI adoption can be facilitated by digital literacy and government encouragement but hindered by issues of privacy. Likewise using extensive mixed-methods research that equity-focused design needs to be a priority in developing AI to benefit marginalized communities. In fintech [20] noted AI-assisted NLP-based chatbots and robo-advisors lead to increased hyper-personalization, but raised a concern regarding bias and a loss of transparency, especially within developing countries. Research in healthcare adoption of AI voice assistants [5] and in financial services, again demonstrated that digital literacy and trust perceptions shape the propensity to adopt, while overreliance on automation undermines inclusivity. Finally [14] supplied experimental evidence that AI-mediated communication reduces perceived benevolence and integrity as compared to human-only communication, underlining the relational trust challenges of AI-heavy interactions.

Despite the varied settings, two gaps remain unaddressed in most analyses. First, few studies consider the adoption of AI and customer satisfaction simultaneously, without any analysis to determine the interplay between the satisfaction levels for the different preferred banking channel types (traditional, digital, and hybrid channels, for that matter). Second, a few studies suggest the enabling aspect of digital literacy for the adoption of AI, for example, [6], [5], [21] while the exploration between the two is unaddressed. This study hypothesizes whether less digitalized consumers in the public prefer the traditional and the hybrid banking channel types, while the digitally savvy consume more in the AI-enabled banking modes in general. This study, by locating the importance of customer satisfaction in the intersection between the preference for technological innovations and the capability to properly utilize them, serves to advance the study in multi-disciplinary Indian universities and the banking environment in general.

## 3. METHODOLOGY

### Research Methodology

The research study involves customers who are utilizing AI-based banking services. The customers are based in the city of Bangalore, India. Because the number of customers was unknown and the population is infinite, a sampling technique for a research study among infinite populations was used. This is based on Cochran's formula. For a confidence level of 95%, the probability ( $p = 0.5$ ), and a margin of error

= 5%, the minimum number for the research sampling requirements is 385 respondents. In this regard, a convenience sampling technique is used to get the respondents for the research study.

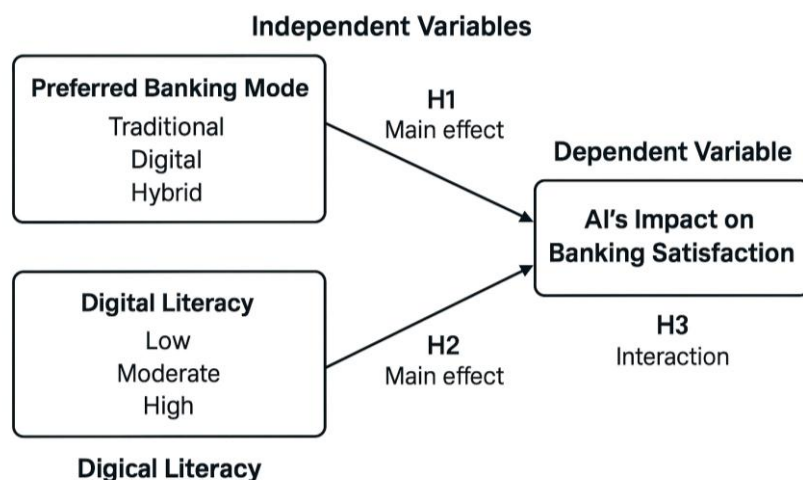


Figure 1. Research Model Diagram

The study adopted a quantitative cross-section survey design. The data collection tool used was a planned questionnaire specifically tailored to suit the study. As Shown in the Figure 1 above, the study used Preferred Banking Mode (Factor A), Digital Literacy (Factor B), and the Impact of AI on Banking Satisfaction (Dependent Variable) to gather data. The dependent variable was measured using five questions that were in Likert scale questions and used customers' perceptions of satisfaction with AI banking services.

The gathered data was processed and analyzed using the SPSS software. Descriptive statistics were used to analyze the demographic and study variables. The internal consistency of the scale used in determining customer satisfaction was tested using Cronbach's alpha analysis. The final test used to analyze the main effect of Preferred Banking Mode, the main effect of Digital Literacy, and the interaction effect on customer satisfaction was the Two-Way ANOVA.

### Data Analysis and Interpretation

**Demographic Statistics:** The demographic analysis was carried out on 390 participants, with no missing values for the variables.

Table 1. Gender of the Respondents

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	269	69.0	69.0	69.0
	Male	121	31.0	31.0	100.0
	Total	390	100.0	100.0	

As shown in the Table 1 above. Among 390 participants, 69% were female, with 121 participants, while 31% were male. This reflects gender imbalanced data that may affect perceptions of satisfaction with AI technology in banking because gender can be a determining factor for technology adoption, according to previous studies.

Table 2. Age of the Respondent

Age_Group					
Frequency		Percent		Valid Percent	Cumulative Percent
Valid	26-35	8	2.1	2.1	2.1
	36-45	100	25.6	25.6	27.7
	Above 45+	67	17.2	17.2	44.9
	Below 25	215	55.1	55.1	100.0
	Total	390	100.0	100.0	

As shown in the Table 2 above, the predominant group of respondents hailed from the below 25 years (55.1%), 36-45 years (25.6%), above 45 years (17.2%), and 26-35 years (2.1%) categories. This prominence of the younger demographic serves as a reminder that younger, online-savvy customers are the main respondents, which is no different from the prevailing international trend wherein younger cohorts are the most active users of online banking services.

Table 3. Qualification of the Respondents

Qualification					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Graduate	215	55.1	55.1	55.1
	PhD / Doctorate	8	2.1	2.1	57.2
	Post Graduate	167	42.8	42.8	100.0
	Total	390	100.0	100.0	

As shown in the Table 3 above, the educational levels indicated that 55.1% were graduates, 42.8% postgraduates, and 2.1% for PhD/Doctorates. This high level of education implies that enough knowledge and skills for assessing AI financial services are bestowed upon the respondents.

Table 4. Respondents Statistics for Preferred Banking Mode (PBM)

PBM					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Digital	222	56.9	56.9	56.9
	Hybrid	113	29.0	29.0	85.9
	Traditional	55	14.1	14.1	100.0
	Total	390	100.0	100.0	

As shown in the Table 4 above, the variation showed a strong lean towards digital banking, with a whopping 56.9% favoring the digital method, followed by the hybrid model, where 29% were in favor, and a meager 14.1% in favor of the conventional banking model. Though it's a strong drift towards digital, close to a third prefer a combination of the conventional and the digital methods.

Table 5. Respondents Statistics for Digital Literacy (DL)

DL					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High	19	4.9	4.9	4.9
	Low	98	25.1	25.1	30.0
	Moderate	273	70.0	70.0	100.0

	Total	390	100.0	100.0	
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As shown in the Table 5 above, the digital literacy levels showed that 70% of the participants exhibit moderate digital literacy, while 25.1% exhibit low digital literacy skills and only 4.9% exhibit high digital literacy skills. This implies that while most participants possess the skills to undertake digital tasks, the number of participants who possess high digital skills is minimal. It also becomes evident that digital literacy skills exist on a continuum.

**Table 6.** Table Showing Reliability Statistic's

Reliability Statistics			
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items		N of Items
.915	.921		6
Scale Statistics			
Mean	Variance	Std. Deviation	N of Items
24.3877	2.988	1.72871	6

As shown in the Table 6 above, the internal consistency of the six-item measure of customer satisfaction (SAT1 to SAT6) was estimated for reliability using Cronbach's Alpha test result value of 0.915 (0.921 standardized), much above the required level of 0.70 for satisfactoriness. The average value of the test is 24.38 with variance of 2.988 and Standard Deviation of 1.728. This indicates low variability. The average scores of individual items were between 4.04 to 4.08 with Standard Deviations of 0.28 to 0.37, showing positive consistency of the respondents on being satisfied with the AI-based banking services.

### Interpretation

The demography reveals predominance in terms of educated females in their youth age group favoring digital banking but in lower numbers regarding highly technically competent customers. The value of Cronbach's Alpha (.915) illustrates that the six-item satisfaction scale has statistical validity. The item means around 4.0 on a scale of 5 for a Likert scale reveal customer satisfaction with AI-based banking on a positive note.

### Univariate Analysis of Variance (Two-Way ANOVA)

A two-way ANOVA was conducted to analyse the main and interaction effects of the Preferred Banking Mode (PBM) and Digital Literacy (DL) on AI-enabled banking satisfaction (SAT).

**Table 7.** Between Subjects Factors Statistics

Between Subjects Factors		
		N
PBM	Digital	222
	Hybrid	113
	Traditional	55
DL	High	19
	Low	98
	Moderate	273

**Table 8.** Univariate Analysis of Variance

Tests of Between-Subjects Effects					
Dependent Variable: SAT					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.

Corrected Model	834.971 <sup>a</sup>	8	104.371	121.410	.000
Intercept	60772.895	1	60772.895	70694.232	.000
PBM	265.007	2	132.504	154.135	.000
DL	367.416	2	183.708	213.699	.000
PBM * DL	246.380	4	61.595	71.651	.000
Error	327.530	381	.860		
Total	233118.720	390			
Corrected Total	1162.501	389			
a. R Squared = .718 (Adjusted R Squared = .712)					

### Between Subjects Factors

As shown in the Table 7, Table 8 above, the distribution of the sample was made up of 222 who preferred digital banking, 113 who preferred hybrid banks, and 55 who preferred traditional banks. For digital literacy, there were 19 who had high levels of digital literacy, 98 who had low digital literacy, and 273 who had moderate digital literacy.

### ANOVA Results

This test brought out the presence of highly significant main effects on both factors. The Preferred Banking Mode is found to have a highly significant effect on the satisfaction,  $F(2,381) = 154.14$ ,  $p < .001$ , which implies that there is a difference among the satisfaction levels of digital, hybrid, and traditional banking institutions. Subsequently, it was also found that the Digital Literacy had a highly significant main effect on satisfaction,  $F(2,381) = 213.70$ ,  $p < .001$ , addressing that there is a difference among the satisfaction levels of people with low, medium, and high digital literacy. Notably, there was also a highly significant interaction effect on PBM and DL,  $F(4,381) = 71.65$ ,  $p < .001$ , indicating that there is dependency between customers' digital literacy levels and satisfaction levels affecting banks' mode of functioning. This model accounted for 71.8% of total variance for banking satisfaction, with R-squared of .718 and Adjusted R-Squared of .712, which holds good for behavioral models.

### Hypotheses Testing

The below hypotheses were formulated and tested by using a two-way ANOVA, with variables including Preferred Banking Mode (PBM) and Digital Literacy (DL) using them as independent variables, and the AI-enabled Banking Satisfaction (SAT) as the dependent variable in the study.

#### Hypothesis 1 (PBM Hypothesis on Main Effect)

- **Null Hypothesis ( $H_{01}$ ):** Mean satisfaction is equal across all Preferred Banking Modes.
- **Alternative Hypothesis ( $H_1$ ):** Mean satisfaction differs across Preferred Banking Modes.
- **Result:**  $F(2,381) = 154.135$ ,  $p < .001$ .
- **Decision:** Reject  $H_{01}$ ; Accept  $H_1$ .

There is a significant main effect of Preferred Banking Mode on satisfaction. Customers using Digital mode reported the highest satisfaction, followed by Hybrid, while Traditional mode users showed the lowest satisfaction levels.

#### Hypothesis 2 (DL Hypothesis on Main Effect)

- **Null Hypothesis ( $H_{02}$ ):** Mean satisfaction is equal across all Digital Literacy levels.
- **Alternative Hypothesis ( $H_2$ ):** Mean satisfaction differs across Digital Literacy levels.
- **Result:**  $F(2,381) = 213.699$ ,  $p < .001$ .
- **Decision:** Reject  $H_{02}$ ; Accept  $H_2$ .



There is a significant main effect of Digital Literacy on satisfaction. Respondents possessing the High digital literacy demonstrated the greatest satisfaction in the study, while those with Low literacy have reported the least.

### Hypothesis 3 (PBM × DL Hypothesis on Interaction Effect)

- **Null Hypothesis (H<sub>03</sub>):** There is no interaction effect between PBM and DL on satisfaction.
- **Alternative Hypothesis (H<sub>3</sub>):** There is a significant interaction effect between PBM and DL on satisfaction.
- **Result:**  $F(4,381) = 71.651, p < .001$ .
- **Decision:** Reject H<sub>03</sub>; Accept H<sub>3</sub>.

There is a significant interaction effect between Preferred Banking Mode and Digital Literacy on satisfaction. Satisfaction in the Digital environment is high only for the High digital literacy group, whereas for the Low group, satisfaction is high for Hybrid or Traditional banking modes.

**Model Fit:** The results for the overall model showed  $R^2 = 0.718$  (Adjusted  $R^2 = 0.712$ ), showing the model accounts for a significant 71.8% variation in banking satisfaction based on PBM, DL, and the interaction between the two. This is a strong model in the field of behaviour and social sciences.

**Interpretation:** Post-hoc (Tukey's HSD) tests showed that customers with high digital literacy in digital banking services were most satisfied with the services, while customers with low digital literacy preferring traditional banking services were least satisfied. In the hybrid structure, the customers with mid-range digital literacy were moderately satisfied with the banking services. This outcome validates that customers' preferences for services and digital literacy capabilities have pivotal roles to play in catering to customer satisfaction. Their joint significance is imperative in customers' acceptance of AI-based banking services.

## 4. RESULTS AND DISCUSSION

### Comparison with Past Studies

The current study verifies that the factors of Preferred Banking Mode (PBM) and Digital Literacy (DL) have a strong effect on satisfaction with AI-powered banking. These results are in line with those of [1], who found that trust and satisfaction are increased with improved service quality in a digitally supported environment. Also supported are, which suggested a sufficient improvement in efficiency with the help of digital services but also reiterated the primacy of human aspects in customer satisfaction. This suggests a general support for hybrid satisfaction in the current study. The prominent presence of digital literacy in the proposed framework is in accordance with [22], who suggested that the skill to leverage financial innovation lies in technology. However, emphasis is also in line with [5], who cited that AI adoption increases in a digitally apt population. However, the results are also in support of the claim set forward in the assertions of ongoing studies: that human involvement and traditional satisfaction trends are in demand.

### Theoretical and Practical Implications

Theoretically, it has been contributed by combining service mode preference and digital literacy to come up with a framework that fills the gap found within models related to satisfaction for banking with AI. This serves to confirm models associated with socio-technical elements by identifying that it is indeed dependent on both technology and human elements. From a more practical perspective, recommendations would lead to dividing their market based on digital literacy with corresponding approaches towards digital assistance for those with high, moderate, or low literacy.

### Explanations for Unexpected Results

It was a surprise to note that the percentage for those with a high degree of digital literacy is low (4.9%). This is contrary to the fact that the population is dominated by the young, as the greatest number



indicated a moderate degree of digital literacy, and this defies the presumption that the younger population is significantly digital-savvy.

## 5. CONCLUSION

The two-way ANOVA test clearly supported that Preferred Banking Mode (PBM) and Digital Literacy (DL) have a positive influence on customer satisfaction towards AI-powered banking, but most importantly, there is an important interaction effect that asserts that satisfaction levels are higher in the digitally literate community in digital banks, then in hybrid banks, and lowest in traditional banks and in people who lack digital literacy skills. The aforementioned variables explained 71.8% of the satisfaction variance levels in the study and therefore have important explanatory power. However, due to the fact that there is only one location examined and due to the non-random selection in the study that consists mainly of young and educated individuals, there is an important restriction in the current study's generalizability, and most importantly, there is no longitudinal data on digital skills and adoption and therefore future studies in that field are important in order to introduce additional moderators like Gender, Income, and Trust in AI Systems in order to further examine the impact of digital literacy plans on customer satisfaction levels.

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### Author Contributions Statement

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Syed Salman	✓	✓	✓		✓	✓	✓	✓	✓	✓			✓	
Dr. Chaya R	✓	✓		✓		✓	✓	✓		✓	✓	✓		

C : Conceptualization

M : Methodology

So : Software

Va : Validation

Fo : Formal analysis

I : Investigation

R : Resources

D : Data Curation

O : Writing - Original Draft

E : Writing - Review & Editing

Vi : Visualization

Su : Supervision

P : Project administration

Fu : Funding acquisition

### Conflict of Interest Statement

The authors declare no conflicts of interest in relation to this work.

### Informed Consent

As this paper is based on a theoretical and literature-based approach, no primary data involving human participants was collected at this stage. Therefore, informed consent was not applicable.

### Ethical Approval

This study did not involve any human or animal participants directly and is based purely on secondary data and theoretical analysis. Hence, ethical approval was not required.

### Data Availability

Primary data was generated and analyzed during this study. All supporting materials and sources have been appropriately cited within the manuscript. Derived data supporting the findings of this study are available from the corresponding author Syed Salman on request.

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