RESEARCH PAPER

INVESTIGATING THE ROLE OF DIGITAL BANKING IN SHAPING THE FINANCIAL BEHAVIOR OF CONSUMERS IN THE TRIVANDRUM DISTRICT OF KERALA

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ABSTRACT

Digital banking (DB) is playing a significant role in driving financial inclusion, economic development, and consumer empowerment by providing safe, technology-driven financial services. Despite these advantages, its use is still restricted due to security concerns, low digital literacy, and poor Internet connectivity, especially in the regional context of Trivandrum district in Kerala. This research examines the effect of security, digital literacy, connectivity, customer engagement, and social acceptance on consumers' financial behavior and digital banking adoption. Structured questionnaires were used to gather primary data from 300 individual users, representatives from the financial institutions, and local stakeholders. Descriptive statistics, correlation analysis, and chi-square tests were used to analyze the collected data to examine the relationships between the study variables using SPSS. The statistically significant results are used to propose a conceptual Synaptic Intelligent Convolutional Neural Network (SICNN) framework to illustrate the possibilities of considering behavioural and technological factors for future AI-based adoption of digital banking. The results show that customer involvement plays a positive role in the usage of digital banking, whereas security, digital literacy, and connectivity have a positive impact on adoption. Regional variations in social acceptance also serve as an indicator of the need for region-specific implementation strategies. The study is one of the first to merge the Unified Theory of Acceptance and Use of Technology (UTAUT) with empirical statistical analysis to provide a conceptual decision-support framework for future digital banking prediction using AI. The results have implications for policymakers and financial institutions to augment cybersecurity, digital literacy, digital infrastructure, and sustainable and inclusive digital banking adoption.

Keywords: *Digital banking, Trivandrum district, Customer engagement, societal perceptions, Challenges, Future trends, Synaptic Intelligent Convolutional Neural Network.*

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INTRODUCTION

Digital banking (DB) is defined as technology-based financial services delivered over the internet and mobile devices, and has revolutionized the global financial landscape, providing secure, tech-enabled financial services to customers via the internet and mobile devices [1]. AI, cloud computing, and fintech innovations have enhanced the accessibility, efficiency, and customer experience of banking, driven financial inclusion and economic growth [2], [3]. Digital India, Pradhan Mantri Jan Dhan Yojana (PMJDY), Unified Payments Interface (UPI), and the Reserve Bank of India (RBI)'s digital payment policies have been instrumental in promoting digital banking in India [4]. While these developments have taken place, the problems of digital illiteracy, awareness of cybersecurity, internet access, and consumer trust remain significant barriers to using digital banking services, especially in semi-urban and regional locations [5].

Digital banking has emerged as a crucial means for financial inclusion, allowing consumers to access financial services, such as savings, payments, credit, and other services, regardless of their geographical location [6], [7]. The high literacy rate and the growing digital infrastructure have led to significant growth in digital financial transactions in Kerala [8]. But the difference in digital literacy, technology acceptance, customer acceptance, and social acceptance still has an effect on consumers' financial behavior between the various districts [9]. To ensure equitable access to DFIs and support sustainable economic development, it is crucial to understand the differences among regions and design policies accordingly [10].

The existing studies have mainly focused on the technology acceptance, customer satisfaction, trust, perceived usefulness, and service quality models. Most investigations, however, do take place at the national or metropolitan level and draw primarily on conventional statistical methods, thus providing little evidence from district-level settings. Furthermore, there is little research that explores the

joint effects of security, digital competence, connectivity, customer engagement, and social acceptability on consumer financial activities, while also incorporating the use of intelligent predictive models to capture the complex interactions among the determinants. One of the areas that needs improvement in digital banking is its ability to make it more secure with the help of frequently repeated technologies aimed at securing the customer data and inculcating trust [11]. Raising digital capacity, particularly in areas of historic disenfranchisement, can enhance connectivity and lessen outages [12]. Improving digital literacy training can help customers to navigate confidently the digital services [13]. Smoothing out the regulation formats and making room for government and financial institution collaboration could help progress innovation and ensure compliance [14]. Engaging, accessible policy development helps vulnerable groups, potentially narrowing the digital divide and improving financial inclusion [15].

Based on these gaps, this study aims to explore the effect of digital banking on the financial behavior of consumers in the Trivandrum district of Kerala. The study explores the relationships between the key determinants of digital banking adoption by using descriptive statistics, correlation analysis, and chi-square analysis to analyze data gathered from 300 respondents. For future digital banking adoption, a conceptual Synaptic Intelligent Convolutional Neural Network (SICNN) framework is proposed based on the empirical findings to show how statistically significant behaviors and technologies may be leveraged to predict digital banking adoption. The study adds to the existing literature by offering empirical evidence at the district level, the incorporation of behavioral and technological factors in the Unified Theory of Acceptance and Use of Technology (UTAUT), and an intelligent conceptual framework for future decision-making processes in digital banking. The results have policy, financial institution, and technology implications: increasing the cybersecurity of the digital banking system, increasing digital literacy, improving digital infrastructure, and fostering inclusive and sustainable digital banking adoption.

1.1 Research Questions

- What is the nature of the connection between customer engagement and usage patterns in digital banking services (DBSs) in Trivandrum district?
- How do societal perceptions and understanding of digital banking trends vary within the Trivandrum district?
- What are the key challenges and limitations hindering the seamless integration of digitalization in the banking sector of Trivandrum district?
- How predictable are the anticipated future trends and developments in DB within the Trivandrum district?

1.2 Objectives

The main objectives of the study include

- To analyze the level of customer engagement and usage patterns in DBSs within the Trivandrum district.
- To investigate the prevailing societal perceptions and understanding of digital banking trends within the Trivandrum district.
- To explore and understand potential challenges and limitations hindering the seamless integration of digitalization in the banking sector of Trivandrum district.
- To prognosticate and assess the anticipated future trends and developments in DB within the Trivandrum district.

The remaining manuscript is as follows: Part 2 gives the Literature Review, Part 3 discusses the Proposed Methodology, Part 4 focuses on Hypothesis Formulations and Testing, Part 5 focuses on the case study, and Part 6 covers the findings, suggestions, and conclusion.

1. LITERATURE SURVEY

Several research works presented in the literature were based on the DB impact on consumer financial behavior; a few of them were reviewed here,

2.1. Determinants of Digital Banking Adoption and User Retention

Several research works have been carried out to identify various factors that affect digital banking adoption and customer retention. The findings from studies by Chinnasamy et al. [16] suggest that technology acceptance based on a trust-embedded Technology Acceptance Model (TAM) positively influences customers' intention to use digital banking services through their perceived usefulness, ease of use, user satisfaction, and trust in India. In the work done by Pratama [17], task-technology fit (TTF), system quality (SQ), and performance expectancy (PE) were used in expanding technology acceptance, and it was found that performance expectancy and user satisfaction were the strongest indicators of continued intention for using the service. Using an extended TAM-UTAUT framework, Aria and Sacco [18] concluded that user satisfaction had a strong effect on customer loyalty and retention in digital banking services. From an innovation point of view, Shaikh and Amin [19] extended Innovation Diffusion Theory (IDT) and came up with the determinants of digital banking adoption as self-efficacy in the use of technology, perceived expected benefits, relative

advantage, and compatibility, while perceived complexity showed no significant effect. In addition, Demirel & Topcu [20] also revealed that chatbots that use AI contribute much better to the development of mobile banking than video call systems due to intelligent customer interactions. Moreover, it is worth noting the findings of Dangaiso et al. [21], which showed that good e-banking service quality leads to customer satisfaction, positive e-WOM, and customer loyalty. All these studies show the importance of technology acceptance, AI-based innovations, system quality, trust, and customer satisfaction as critical factors of digital banking adoption.

2.2. Enhancing Digital Banking Services through Efficiency and Technological Integration

The recent studies indicate that improvements in digital banking can be achieved through the combination of operational efficiency, new technologies, and customer-oriented approaches. According to Khan et al. [22], efficiency, reliability, safety, security, and responsiveness are important determinants of customer satisfaction and sustainable performance of e-banking, where efficiency and reliability have the greatest impact on customers' perception. Alghizzawi et al. [23] showed that the use of business intelligence systems such as e-payments, ATMs, and financing services contributes significantly to the improvement of the quality of digital banking services as well as the competitive advantages of Islamic banks. In addition, Mamadiyarov [24] underlined the significant changes that can be made in the sphere of digital banking due to the implementation of artificial intelligence (AI), because chatbots, predictive analytics, and fraud detection systems contribute to customer satisfaction, operational efficiency, and risk management, although there are some problems with data protection. According to Mookerjee et al. [25], digital banking provides financial inclusion in rural areas. Complementing these findings, Bueno et al. [26] identified Industry 4.0 technologies, digital business models, and operational efficiency as critical drivers of digital banking transformation, proposing future research directions focused on customer experience, service optimization, and digital operational efficiency.

2.3. Research Gap

While digital banking has grown rapidly and become widely adopted as a transformative area of financial services, the literature has primarily focused on technology adoption and service efficiency, with few researchers targeting the more complicated ways digital banking affects consumers' financial behaviors. Much of the current literature does not examine how consumers from different demographic groups respond differently to digital banking tools that affect how they spend, save, borrow, or invest. There is insufficient research examining the longer-term behavioral changes fostered by personalized digital financial products, immediate payments, and access to credit, especially in emerging and underbanked markets. There is a need to study digital banking; the investigation of finance-related change in communities overlooked by financial services and health and wellness practitioners will contribute to their knowledge emanating from rapidly evolving areas of scholarship. In general, the effects of online banking on customers' financial well-being, decision-making, and risk have yet to be examined thoroughly. This existing gap highlights the need for research that examines the implications of digital banking behaviour in different socioeconomic contexts so that better and more informed financial products and policies can be designed to contribute to consumer financial health and literacy, and ultimately, their financial behaviour.

2. THEORETICAL FRAMEWORK

3.1. Unified Theory of Acceptance and Use of Technology (UTAUT)

UTAUT was introduced by Viswanath Venkatesh et al. (2003) as a theory that attempts to explain the adoption of technology in terms of performance expectancy, effort expectancy, social influence, and facilitating conditions that drive both behavioral intention and usage. This research is based on UTAUT, which is a well-known theory explaining technology adoption and usage behavior through behavioral and social factors. UTAUT claims that the usage of technology is affected by social influence, facilitating conditions, and behavioral intention, leading to actual usage behavior. In terms of digital banking, customer engagement means users' behavioral intention towards interacting with digital financial services, while society perception refers to social influence on technology acceptance. Security, digital literacy, and internet connection are facilitating conditions for digital banking adoption. Thus, the UTAUT model offers the theoretical background for studying the correlation between customer engagement and use of digital banking (H1) and societal perception and adoption of digital banking (H2). Combining the Unified Theory of Acceptance and Use of Technology (UTAUT) with statistical analysis, this paper offers an understanding of the behavioral factors that affect digital banking adoption. Moreover, the concept of Synaptic Intelligent Convolutional Neural Network (SICNN) is introduced in order to show how these factors can be used for predicting consumer behavior in the future using artificial intelligence.

Hypothesis 1: Customer engagement is significantly associated with the usage patterns of

digital banking services (DBSs) in the Trivandrum district.

Hypothesis 2: Societal perceptions and understanding of digital banking significantly influence digital banking awareness and adoption in the Trivandrum district.

3. PROPOSED METHODOLOGY

The research process starts off with a definition of the research goals and research questions in order to get an in-depth understanding of digital banking adoption and consumer behavior in the Trivandrum district. A thorough research design is then created in order to figure out the appropriate research method and data sources. Data are collected using primary means through a structured questionnaire survey of digital banking users. In addition, secondary data collection takes place through governmental reports, bank publications, and relevant literature. These data are analyzed using SPSS through descriptive statistics, correlation analysis, reliability analysis, and hypothesis testing in order to find out the influential factors on digital banking adoption. On the basis of the findings, a conceptual Synaptic Intelligent Convolutional Neural Network (SICNN) framework is developed to show how various behavioral, demographic, and technological variables can be incorporated into an intelligent decision support system for prediction purposes. It should be noted that the Synaptic Intelligent Convolutional Neural Network (SICNN) framework is a concept to be implemented in the future and not an experimentally verified model at the current stage of this research. Figure 1 illustrates the proposed conceptual SICNN-based framework.

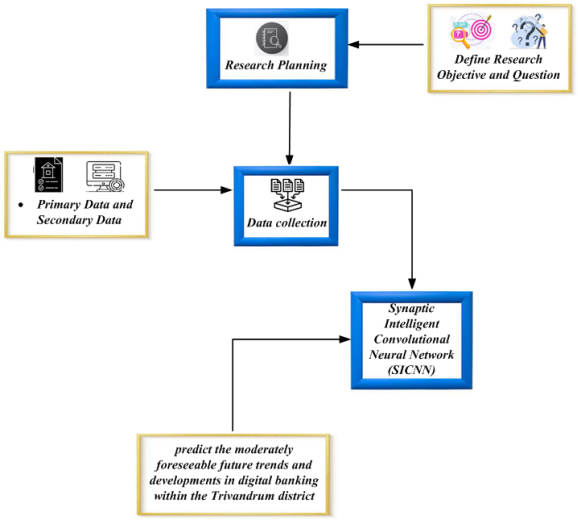

Figure 1: Block Diagram of the Proposed Method

4.1 Proposed Conceptual Synaptic Intelligent Convolutional Neural Network (SICNN) Framework

This section presents a conceptual Synaptic Intelligent Convolutional Neural Network (SICNN) framework that illustrates how future artificial intelligence techniques could support the prediction of digital banking adoption and consumer financial behavior within the Trivandrum district [21]. The model parameters are denoted θ by as the kth parameter. The importance θ_k of forecasting tasks μ is represented by ω_k^{μ}, which measures its contribution to minimizing the prediction error specific to that task μ. Regarding the Trivandrum district's digital banking trends, it reflects how much the accuracy of predicting moderately foreseeable future developments improves, as shown in equation (1),

$$L\left(\theta\left(t_{\mu}\right)\right)-L\left(\theta\left(t_{\mu-1}\right)\right)=-\sum_{k}\omega_k^{\mu} \quad (1)$$

The negative sign is introduced because the focus is typically on reducing prediction error. The expression represents the change in error between the endpoints. $\theta\left(t_{\mu}\right)$ and the starting point $\theta\left(t_{\mu-1}\right)$. Since the gradient field is conservative, we can infer from calculus that this error change is equivalent to the gradient vector field's path integral along the factor trajectory from the starting point. $\theta\left(t_{\mu-1}\right)$ to the endpoint $\theta\left(t_{\mu}\right)$. It is used to predict moderately foreseeable future trends and developments in digital banking within the Trivandrum district, as shown in equation (2).

$$\int_{c} g(\theta(t))d\theta=\int_{t_{\mu-1}}^{t_{\mu}} g\left(\theta_t\right)\cdot\theta^{'}(t)dt$$

(2)

$$L\left(\theta\left(t_{\mu}\right)\right)-L\left(\theta\left(t_{\mu-1}\right)\right)=\int_{t_{\mu-1}}^{t_{\mu}} g\left(\theta_t\right)\cdot\theta^{'}(t)dt$$

(3)

Here $g\left(\theta_t\right)=\left[\ldots\ldots,\frac{\partial L_{\mu}}{\partial\theta_k},\ldots\ldots\right]$ indicates the gradient of the error function regarding the factor as a vector. The following mathematical expressions provide the theoretical foundation of the proposed SICNN framework and describe how model parameters may be optimized in a future implementation for digital banking prediction. These formulations are presented conceptually and are not empirically estimated in the present study. The proposed SICNN framework conceptually illustrates how future intelligent systems may utilize significant behavioral and technological variables to predict digital banking adoption and consumer financial behavior. In the present study, empirical validation is performed using SPSS-based statistical analyses,

while the SICNN framework is presented as a future AI-assisted decision-support model.

4.2 Research Design

The study uses a quantitative, cross-sectional methodology to investigate the effect of digital banking on consumer financial behavior in the Trivandrum district of Kerala. The study is based on the UTAUT theory, which will be the foundation of the study to explore the behavioral and technological factors impacting digital banking acceptance. The SICNN conceptual model suggested in this study supports the empirical model as an example of an AI-supported decision-support system.

4.3 Population, Sampling, and Sample Size

The targeted group is made up of individuals who use digital banking services within the Trivandrum District. Stratified random sampling was used to make sure there is an equitable number of respondents in terms of demographics like age, gender, education, occupation, and income levels. From Cochran's guidelines on sampling size for social sciences, a total of 300 valid responses were gathered from the targeted group through screening for consistency and reliability.

4.4 Questionnaire Development and Data Collection

Primary data were gathered through the use of a questionnaire survey, which was drawn from digital banking and technology adoption theories. The questionnaire contained two parts; one part was the demographics, while the other part contained measurement items on digital banking adoption. Some of the constructs include customer engagement, security, digital literacy, internet access, social acceptability, and consumer finance behaviors. A five-point Likert scale was used, where the respondents gave responses from 1 (strongly disagree) to 5 (strongly agree). Before full-scale use of the questionnaire, it was checked by experts both academically and professionally for its content validity.

4.5 Industrial Survey

The survey looks at the obstacles, advantages, and motivators behind the adoption of digital banking as well as how it affects consumer financial behavior. The questionnaire, based on existing literature and best practices, will be distributed via online platforms like Google Forms. Respondents were selected utilizing randomized stratified sampling to make sure representation from small, medium, and large rural enterprises. Data collected included both quantitative (Likert-scale responses, influence estimates) and qualitative (consumer experiences, expert insights) information, with statistical validation done using Logistic Regression and FBN. Table 1 presents a systematic summary of expert responses to key questions regarding the effect of online banking on the financial habits of consumers.

Table 1: Expert Responses on the impact of DB on consumer financial behavior

No	Questions	Response Summary
1	Age	18-25, 26-35, 36-45, 46and above
2	Gender	Male, Female
3	Educational qualification	High school, Master's degree, Bachelor's degree, Doctorate
4	Occupation	Employed, Self-employed, Student, Homemaker
5	Annual income	Below 1.5 lakhs, 1.5 lakhs-3 lakhs, 3 lakhs-5 lakhs, Above 5 lakhs
6	Which DB platforms do you most commonly use? (Select all that apply)	Mobile banking apps, Internet

		banking, Unified payments interface apps (eg, Google Pay, PhonePe), ATM services, and other
7	How often do you engage with DB services (mobile banking apps, internet banking, UPI, etc.)?	Daily, Weekly, Monthly, Rarely, Never
8	How satisfied are you with the usability and features of the DB services you use?	Highly satisfied, Satisfied, Neutral, Dissatisfied, Highly dissatisfied
9	What are your common usage patterns in DB transactions? (Select all that apply)	Fund transfers, Bill payments, Mobile recharge, Checking account balance, Loan or credit card payments, Investments, and insurance
10	Do you prefer DB over visiting a bank branch?	Yes, No
11	What is the general societal perception in Trivandrum towards digital banking?	Highly satisfied, Satisfied, Neutral, Dissatisfied, Highly dissatisfied
12	What do you think are the main barriers preventing some people in Trivandrum from using DB? (Select all that apply)	Lack of awareness, security concerns, Lack of digital literacy, Poor internet connectivity, Preference for traditional banking, and other
13	How would you rate the understanding of DB trends among people in your community?	Highly satisfied, Satisfied, Neutral,

		Dissatisfied, Highly dissatisfied
14	How much do you trust DB platforms in terms of data privacy and security?	Highly satisfied, Satisfied, Neutral, Dissatisfied, Highly dissatisfied
15	Do you believe DB is transforming financial behavior and accessibility in the Trivandrum district?	Highly satisfied, Satisfied, Neutral, Dissatisfied, Highly dissatisfied

4.6 Variables and Statistical Analysis

Consumer financial behavior was treated as the dependent variable, while customer engagement, security, digital literacy, internet connectivity, and social acceptance served as independent variables. Data analysis was performed using IBM SPSS Statistics. Descriptive statistics were used to summarize respondents' demographic characteristics. Reliability was assessed using Cronbach's alpha, while correlation analysis examined the relationships among the study variables. Chi-square tests were employed to evaluate associations between demographic characteristics and digital banking adoption. Based on the statistically significant empirical findings, a conceptual Synaptic Intelligent Convolutional Neural Network (SICNN) framework is proposed to demonstrate how these determinants could support future AI-assisted prediction of digital banking adoption and consumer financial behavior.

4. RESULTS AND ANALYSIS

5.1. Descriptive statistics

The demographic data of the study participants are provided in Table 2, which provides important information about the makeup of the Trivandrum district sample population.

Table 2: Demographic statistics

Variables		**Frequency**	**Percentage**
Gender	Male	140	46.7
	Female	160	53.3
Age group	18-25 years	80	26.7
	26-35 years	90	30.0
	36-45 years	60	20.0
	46 years & above	70	23.3
Educational qualification	High school	40	13.3
	Bachelor's degree	120	40.0
	Master's degree	90	30.0
	Doctorate	20	6.7
Occupation	Employed	180	60.0
	Self-employed	50	16.7
	Student	40	13.3
	Homemaker	30	10.0

Annual income	Below 1.5 lakhs	60	20.0
	1.5 lakhs-3 lakhs	90	30.0
	3 lakhs-5 lakhs	70	23.3
	Above 5 lakhs	80	26.7

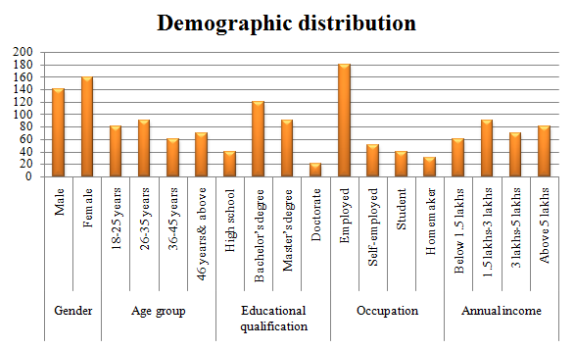

Figure 2: Illustration of demographic distribution

Figure 2 shows the Illustration of demographic distribution. The demographic distribution of respondents in this study on engagement in digital banking shows a fairly balanced representation according to a number of important individual factors. The sample was composed of 46.7% male respondents and 53.3% female respondents. This distribution adds diversity to the perspectives on ways of engaging in digital banking. Ages: 30.0% of respondents were between the ages of 26 and 55, which is the age range most likely to use DBSs. Of the respondents, 40.0% had a bachelor's degree, indicating a well-educated sample in terms of educational attainment. In terms of occupation, 60.05% of the respondents were employed, including self-employed respondents, students, and homemakers. This captures an additional perspective on engagement with digital banking, and it does present quite a range of occupations. The respondents also exhibited diversity in income level, where a significant portion fell into the income brackets of 1.5 lakhs – 5 lakhs, thus likely representing varied economic backgrounds that influence engagement with digital banking. The respondents are primarily well-educated, employed, middle-aged individuals, with varied income levels, ensuring a broad and varied set of insights into patterns of engaging with digital banking and perceptions of different demographic groups.

5.2 Hypothesis Formulations and Testing

Statistical analysis and hypothesis generation were applied to test theoretical models and empirical evidence. Hypotheses for evidence-based research were generated from observed industry patterns, expert opinion, and prior literature. Statistical approaches like regression and correlation, as well as hypothesis testing, allow for the consideration of the interrelationship between customer engagement, societal perceptions, usage patterns, and understanding in digital banking services within the Trivandrum district.

i) ***Hypothesis 1:*** Measure the customer engagement and usage patterns in DBSs. The hypothesis is framed as follows:

H_1 *(Alternative Hypothesis):* There is an important connection between customer engagement and usage patterns in DBSs in the Trivandrum district.

H_0 *(Null Hypothesis):* There is no important connection between customer engagement and usage patterns in DBSs in the Trivandrum district.

To validate this hypothesis, a structured survey is designed and administered to a diverse group of respondents, including digital banking users, bank officials, financial technology professionals, and local customer service representatives. The survey attempted to establish their opinions regarding customer engagement levels, patterns of usage in digital banking platforms, and the connection between user behavior and the effectiveness of DBSs. Table 3 shows the survey questions and responses.

Table 3: Survey Questions and Response

No	Survey Questions	Response (Likert Scale)
1	Customer Engagement	Daily, Weekly, Monthly, Rarely, Never
2	Usage patterns in digital banking services	Fund transfers, Bill payments, Mobile recharge, Checking account balance, Loan

		or credit card payments, Investments, and insurance

Statistical Testing: Correlation Testing

Correlation analysis refers to a statistical connection, whether or not it is causal, between two arbitrary variables or bivariate data. Because they can reveal a predictive relationship that can be used in practice, correlations are helpful. It facilitates comprehension of how modifications to one variable impact modifications to another. From -1 to 1, the correlation coefficient can be used to express the result of the correlation analysis. A correlation coefficient of 1 indicates a perfect positive correlation, meaning that when one variable rises, the other one rises in proportion. A perfect negative correlation, where one variable rises proportionately to another, is designated by a correlation coefficient of -1. The variables have little to no linear relationship when the correlation coefficient is near zero.

$$r = \frac{\sum (x_i - \bar{x})\ (y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2\ (y_i} - \bar{y})^2}$$

Where $\bar{y}$ is indicated as the mean of the values of the y variable, r is denoted as the correlation coefficient, x_i is denoted as the values of the x variable in the sample, $\bar{x}$ is denoted as the mean of the values of the x variable, and y_i is indicated as the values of the y variable in the sample. Table 4 displays that result of the correlation analysis.

Table 4: Result of Correlation Analysis

	Customer Engagement	**Usage Patterns In Digital Banking Services**
Customer Engagement	Pearson correlation Sig. (2-tailed) N	1 50	0.72 0.001 50
Usage Patterns In Digital Banking Services	Pearson correlation Sig. (2-tailed) N	0.72 0.001 50	1 50

This analysis shows a strong connection between customer engagement and usage patterns in DB services in the Trivandrum district. The Pearson correlation coefficient (r = 0.72), a strong positive coefficient, clearly indicates that customer engagement is associated with increasing use of services through digital banking channels. This connection is significant at the 0.001 levels or better ($p < 0.001$), indicating a clear statistical relation, well beyond the threshold for significance (0.05). These results indicate that consumers engaged with digital banking platforms tend to use a greater array of services more often. Overall, the relationship in strength and significance suggests that customer engagement has a critical role in the usage of digital banking, highlighting the need for financial institutions to advance strategies for increasing user engagement and satisfaction. Reject H_0 and accept H_1: There is an important connection between customer engagement and usage patterns in DBSs in the Trivandrum district.

ii) Hypothesis 2: Measuring the societal perceptions and understanding of digital banking trends within the Trivandrum district. It explores the digital banking awareness in the Trivandrum district.

H_1 (Alternative Hypothesis): There is an important connection between societal perceptions and understanding of digital banking trends within the Trivandrum district.

H_0 (Null Hypothesis): There is no important connection between societal perceptions and

understanding of digital banking trends within the Trivandrum district.

To test this hypothesis, a structured survey was conducted and distributed to digital banking users, bank officials, technology experts, and community members in the Trivandrum district. Table 5 displays the survey questions and responses.

Table 5: Survey Questions and Response

No	Survey Questions	Response (Likert Scale)
1	Societal Perceptions	Satisfied, Neutral, Dissatisfied, Highly satisfied, Highly dissatisfied
2	Understanding of digital banking	Highly satisfied, Satisfied, Neutral, Dissatisfied, Highly dissatisfied

Statistical Testing: Chi-square test

To determine whether categorical variables have a significant correlation with one another, one statistical method is the chi-square. $\left(\chi^2\right)$ test. It contrasts a dataset's observed frequencies with those that would be predicted in the absence of any correlation between the variables.

There are two main types:

To determine whether 2 categorical variables, like gender and product preference, are related, the chi-square test of independence is utilized.

Chi-square goodness-of-fit test – employed to determine if a sample matches an expected distribution (e.g., expected vs. observed survey responses).

The formula for the chi-square statistic is:

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

Where χ^2 is denoted as chi-squared, O_i is denoted as the observed value and E_i is denoted as the expected value. Table 6 displays the result of the chi-square test.

Table 6: Result of Chi-square test

	Value	df
Pearson Chi-Square	18.67	2
N of Valid cases	300	

The Chi-Square statistic, $\chi^2 = 18.67$ with 2 degrees of freedom and p-value < 0.05, designates that there is statistical significance between societal perceptions and societal understanding of digital banking trends. Since the connection is considered statistically important and the p-value is less than the standard 0.05, the null hypothesis is rejected. This indicates there is a meaningful association between the different societal perceptions and levels of understanding of digital banking trends within the Trivandrum district. Reject H_0 and accept H_1: There is a significant connection between societal perceptions and understanding of digital banking trends within the Trivandrum district.

6. CASE STUDY

This case study provides quantitative data to support the statistical results that highlight the role of DB enablers on consumer financial behaviours in Trivandrum, Kerala. In pursuit of its financial inclusion objectives, such as more savings, use of digital payments, better credit, and investment awareness, the study looks at examples from a variety of institutions. Organization A, a public sector bank, experienced an increase in monthly digital transactions up to 65% (50-65% range), and savings account activity increased by 30% after implementing mobile banking and UPI in semi-urban areas. Organization B, a fintech company, experienced growth in source registered SIPs of 40 to 55%, and emergency funds creation increased by 35 to 45% after providing AI-based financial planning tools for salaried individuals. Organization C, a cooperative bank, saw the digital passbooks and SMS alerts boost balance checks by 25 to 40% and improve account usage by 20 to 30%. Organization D, a mobile wallet company, brought in

QR-based merchant payments, resulting in a 60 to 70% decline in cash transactions, coupled with daily expenses reflecting the specific financial behaviours of consumers. These case examples evidence, in quantitative terms, that digitized financial institutions can lead to observable changes in consumer financial behaviours in the context of accessibility, efficiency, and engagement. Table 7 shows the selected Companies & Their Contributions to financial behavior changes.

Table 7: Selected Companies & Their Contributions to Financial Behavior Changes

Organization	Sector	Technology Used	Key Contribution
Organization A	Public Sector Bank	Mobile banking & UPI services	Increased digital transaction volume by 50–65%, boosted savings account activity by 30%
Organization B	Fintech	AI-based financial planning app	Grew SIP adoption by 40–55%, improved emergency savings by 35–45%
Organization C	Regional Cooperative Bank	Digital passbooks & SMS alerts	Boosted account usage frequency by 20–30%, enhanced financial awareness by 25–40%
Organization D	Mobile Wallet Provider	QR-based local merchant payments	Reduced cash usage by 60–70%, enabled better daily expense tracking.

7. DISCUSSION

These results show that customer engagement is an important factor determining digital banking adoption, with a high positive relationship ($r = 0.72$, $p < 0.001$). This is in agreement with Chinnasamy et al. [16], who found that user satisfaction, usefulness, and trust play a significant role in increasing consumers' intention towards adopting digital banking services. Likewise, Pratama [19] observed that performance expectation and user satisfaction are the two important factors for continuous digital banking usage, which suggests that engaged customers are more likely to use digital banking services often. This current study further adds to this knowledge with the evidence collected from the Trivandrum district of India.

The Chi-square test also confirmed that there is a significant connection between the perception of society and knowledge about the trends of digital banking. It means that awareness and social acceptability impact the adoption of technologies. This result proves the ideas of Mookerjee et al. [22] that stated the importance of digital literacy, digital infrastructure, and awareness in the process of financial inclusion through digital banking. Moreover, according to Bueno et al. [23], digital transformation is possible when it is accompanied by customer acceptance and efficiency.

7.1 Theoretical and Practical Implications

The theoretical contributions include the further development of the use of UTAUT theory in relation to the adoption of digital banking within the regional economy. The research also introduces a conceptual SICNN model illustrating how such behavioral and technological factors can be used to make future predictions regarding the adoption of digital banking with the help of AI. From the practical viewpoint, the results can serve as recommendations for banks and governments on how to increase user engagement, secure their operations with advanced cybersecurity solutions, implement digital literacy programs, and develop the Internet infrastructure.

7.2 Limitations and Future Research

The study has several limitations. First, it employs cross-sectional analysis involving 300 participants within the Trivandrum region, which might hinder its external validity. Second, the self-reports obtained from the survey may be affected by the biases of the respondents. Third, even though a theoretical basis for SICNN is provided, it has not been tested empirically using machine learning. Future researchers may use longitudinal datasets and larger sample sizes across different regions and utilize artificial intelligence models to verify the SICNN framework and enhance predictions regarding digital banking adoption. In addition, future research may include some other factors that affect the adoption of digital banking, for instance, risk perception, trust, financial literacy, and support from regulators.

8. CONCLUSION

This research focuses on investigating the factors that play a role in adopting digital banking and the financial behaviors of consumers in the Trivandrum district of Kerala. According to the empirical analysis using SPSS, correlation and chi-square tests have revealed a significant positive association between customer engagement and digital banking adoption, and societal perception has been seen to play a significant role in affecting people's understanding of digital banking trends. Thus, this research has made it evident that customer engagement, societal perception, and awareness are crucial factors that determine whether the adoption of digital banking will be sustainable or not. According to the statistically significant results, a conceptual Synaptic Intelligent Convolutional Neural Network (SICNN) model can be presented in order to show how the future systems of artificial intelligence can help predict digital banking adoption and customer behavior. This study provides a number of implications for financial institutions and policy makers in terms of cybersecurity, digital literacy, digital infrastructure, and customer-oriented digital services. Further research may focus on validating the SICNN framework with longitudinal datasets and artificial intelligence tools.

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