

AI driven Framework for Real-Time Risk Assessment & Transaction Management in Modern Banking System

Dr.J.Prabhakaran¹, Prof. (Dr.) Ravinder Rena²

¹ PDF Scholar, Lincoln University College, Malaysia; ² Professor of Economics, DUT Business School, Faculty of Management Sciences (FMS) Durban University of Technology

Email ID : pdf.prabhakaran@lincoln.edu.my ravinder.rena@gmail.com

Abstract

The rapid digital transformation of banking has accelerated the adoption of Financial Technology (FinTech) applications, particularly in emerging economies. Despite significant growth in FinTech services, public sector banks continue to face challenges related to customer adoption, trust, security, and real-time transaction risk management. This study develops and validates an integrated FinTech Adoption and Risk Assessment Framework by combining constructs from the Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), and Risk-Benefit Theory. A descriptive research design was employed, and data were collected from 750 FinTech users of major public sector banks in India using a structured questionnaire. Results reveal that perceived ease of use, perceived usefulness, performance expectancy, social influence, facilitating conditions, hedonic motivation, and perceived benefits significantly and positively influence user attitude, while perceived risk negatively affects attitude. The integrated model demonstrated superior fit indices (RMSEA = 0.036, CFI = 0.960, TLI = 0.954) compared with standalone TAM and UTAUT models. Based on empirical findings, a FinTech Risk Assessment and Transaction Management Framework is proposed to enhance adoption, security, and sustainable digital banking growth.

Keywords: FinTech Adoption, Public Sector Banks, TAM, UTAUT, Structural Equation Modeling, Risk Assessment, Digital Banking, Behavioral Intention.

1. Introduction

Financial Technology (FinTech) has transformed the global banking landscape through digital payment systems, mobile banking applications, artificial intelligence, blockchain technology, and real-time financial services. The COVID-19 pandemic significantly accelerated FinTech adoption worldwide, particularly in developing countries such as India, where government initiatives such as Digital India and Unified Payments Interface (UPI) have enhanced digital financial inclusion.

Public sector banks account for a substantial portion of India's banking ecosystem and are increasingly adopting FinTech solutions to improve customer experience and operational efficiency. However, adoption challenges remain due to concerns regarding security, trust, privacy, technological complexity, and transaction risk. Existing studies primarily focus on either behavioral adoption or technological implementation, creating a gap in understanding the combined influence of adoption determinants and risk management strategies.

2. Literature Review

2.1 Technology Acceptance Model (TAM)

The Technology Acceptance Model developed by Davis (1989) identifies perceived usefulness and perceived ease of use as primary determinants of technology adoption.

Perceived Ease of Use (PEOU)

PEOU refers to the degree to which users believe that using a FinTech application requires minimal effort.

Perceived Usefulness (PU)

PU measures the extent to which users perceive FinTech services as enhancing transaction efficiency and effectiveness.

2.2 Unified Theory of Acceptance and Use of Technology (UTAUT)

UTAUT explains technology adoption through:

- Performance Expectancy
- Social Influence
- Facilitating Conditions

These variables significantly influence user behavior in digital banking environments.

2.3 Hedonic Motivation

Hedonic motivation reflects enjoyment and satisfaction derived from using FinTech applications.

2.4 Perceived Risk

Perceived risk includes:

- Financial Risk
- Privacy Risk
- Security Risk
- Operational Risk

Risk perception remains a major barrier to FinTech adoption.

2.5 Perceived Benefits

Perceived benefits include:

- Convenience
- Speed
- Accessibility
- Cost reduction

Higher perceived benefits increase technology acceptance.

3. Research Gap

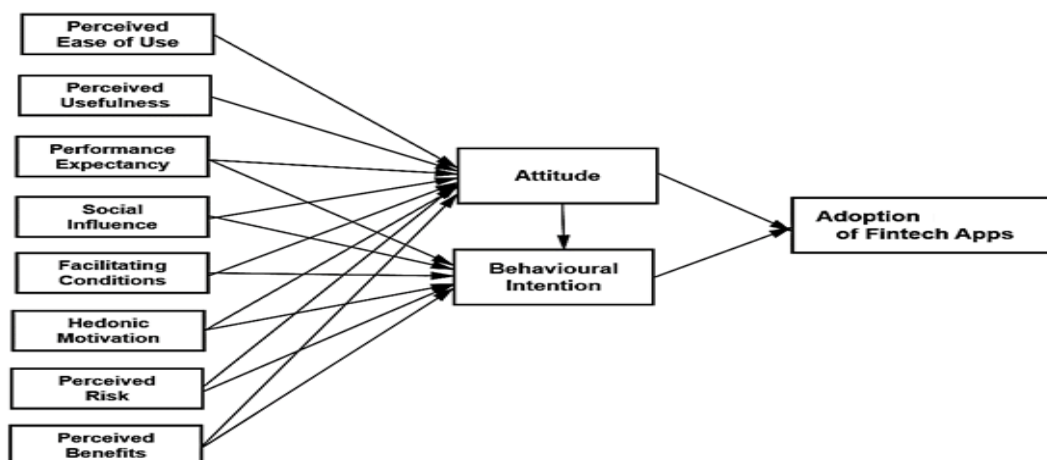
Existing studies reveal several limitations:

1. Limited focus on public sector banks.
2. Insufficient integration of TAM and UTAUT frameworks.
3. Underrepresentation of psychological factors such as risk perception.
4. Limited research on the impact of government digital initiatives.
5. Lack of integration between adoption behavior and transaction risk management.

4. Research Objectives

1. Examine demographic characteristics of FinTech users.
2. Investigate determinants influencing FinTech adoption.
3. Analyze relationships among attitude, behavioral intention, and adoption.
4. Develop an integrated adoption and risk management framework.

5. Conceptual Framework



Independent Variables

1. Perceived Ease of Use (PEOU)

Perceived Ease of Use refers to the degree to which an individual believes that using a FinTech application is free from effort. When customers find FinTech applications easy to learn, navigate, and operate, they are more likely to develop a positive attitude toward using such technologies.

2. Perceived Usefulness (PU)

Perceived Usefulness is defined as the extent to which an individual believes that using a FinTech application will enhance their financial transaction performance and efficiency. It reflects the practical benefits users gain from employing digital financial services.

3. Performance Expectancy (PE)

Performance Expectancy refers to the degree to which users believe that utilizing FinTech services will help them achieve better financial outcomes and improve task performance. Derived from the Unified Theory of Acceptance and Use of Technology (UTAUT), this construct focuses on the expected gains in productivity, efficiency, and effectiveness resulting from technology usage.

4. Social Influence (SI)

Social Influence represents the extent to which individuals perceive that important people in their lives, such as family members, friends, colleagues, and social networks, believe they should use FinTech applications.

5. Facilitating Conditions (FC)

Facilitating Conditions refer to the availability of resources, infrastructure, and support systems that enable users to effectively utilize FinTech applications. These conditions include access to smartphones, internet connectivity, technical assistance, customer support services, digital literacy, and secure transaction environments.

6. Hedonic Motivation (HM)

Hedonic Motivation refers to the enjoyment, pleasure, and satisfaction users derive from using FinTech applications. Beyond functional benefits, users often appreciate engaging interfaces, personalized experiences, rewards programs, gamification features, and innovative digital services.

7. Perceived Risk (PR)

Perceived Risk refers to the potential uncertainty and negative consequences associated with using FinTech services. It encompasses concerns related to financial loss, data breaches, privacy violations, identity theft, transaction failures, and cybersecurity threats.

8. Perceived Benefits (PB)

Perceived Benefits represent the advantages users associate with adopting FinTech applications. These benefits may include convenience, cost savings, accessibility, time efficiency, enhanced financial control, real-time transaction capabilities, and improved customer service.

Mediating Variable

9. Attitude (AT)

Attitude refers to an individual's overall positive or negative evaluation of using FinTech applications. It acts as a psychological mediator between user perceptions and behavioral outcomes. Users who perceive FinTech services as useful, easy to use.

Outcome Variables

10. Behavioral Intention (BI)

Behavioral Intention refers to an individual's conscious plan or willingness to use FinTech applications in the future. It represents the motivational factors that influence actual usage behavior. Behavioral intention is widely recognized as a strong predictor of technology adoption behavior.

11. FinTech Adoption (FA)

It encompasses the frequency, extent, and continuity of using FinTech services such as mobile banking, digital wallets, online payments, investment platforms, peer-to-peer lending.

Strategic Extension Variables

12. Real-Time Risk Assessment (RTRA)

Real-Time Risk Assessment is the continuous process of identifying, evaluating, and mitigating financial and operational risks during digital transactions. Real-time risk assessment enhances security, improves customer trust, and strengthens regulatory compliance in digital banking.

13. Transaction Monitoring (TM)

Transaction Monitoring involves the continuous observation and analysis of financial transactions to identify unusual patterns, suspicious activities, or compliance violations. Effective transaction monitoring helps financial institutions reduce fraud.

14. Fraud Detection (FD)

Advanced fraud detection systems employ machine learning algorithms, behavioral analytics, biometric authentication, and anomaly detection techniques to recognize suspicious transactions in real time.

15. Risk-Based Decision Engine (RBDE)

A Risk-Based Decision Engine is an intelligent analytical system that evaluates transaction risks and automatically determines appropriate actions based on predefined risk thresholds. The engine integrates customer profiles, transaction history, behavioral patterns, risk scores, and regulatory guidelines to support decision-making processes.

6. Research Methodology

Item	Description
Research Design	Descriptive Research
Population	Public Sector Bank FinTech Users
Sampling Method	Quota Sampling
Sample Size	750
Instrument	Structured Questionnaire
Analysis Tool	SPSS 29 & SmartPLS/AMOS
Statistical Techniques	CFA, Correlation, Regression, SEM

7. Measurement Model Assessment

Reliability

All constructs exceeded recommended thresholds:

- Cronbach's Alpha > 0.78
- AVE > 0.50
- Composite Reliability > 0.70

indicating strong internal consistency and convergent validity.

8. Structural Model Results

Model Fit

Fit Index	Obtained Value	Recommended Value	Interpretation
RMSEA	0.036	< 0.08	Excellent Fit
GFI	0.921	> 0.90	Good Fit
AGFI	0.905	> 0.90	Good Fit
CFI	0.960	> 0.95	Excellent Fit
TLI	0.954	> 0.95	Excellent Fit
Chi-square/df	2.946	2 – 5	Good Fit
RMR	0.034	< 0.08	Excellent Fit

The overall model fit statistics indicate that the proposed integrated FinTech Adoption and Risk Assessment Framework exhibits excellent goodness-of-fit. Therefore, the model is considered statistically acceptable and suitable for hypothesis testing and further structural analysis.

9. Regression Results

Predictor	Beta Value	Interpretation
Social Influence	0.249	Strongest Positive Influence
Perceived Benefits	0.206	Strong Positive Influence
Perceived Ease of Use	0.189	Moderate Positive Influence
Perceived Usefulness	0.169	Moderate Positive Influence
Performance Expectancy	0.133	Positive Influence
Facilitating Conditions	0.117	Positive Influence
Hedonic Motivation	0.115	Positive Influence
Perceived Risk	-0.108	Negative Influence

The regression analysis revealed that Social Influence ($\beta = 0.249$) was the strongest determinant of attitude toward FinTech adoption, followed by Perceived Benefits ($\beta = 0.206$), Perceived Ease of Use ($\beta = 0.189$), and Perceived Usefulness ($\beta = 0.169$). Performance Expectancy, Facilitating Conditions, and Hedonic Motivation also exhibited significant positive effects on attitude. In contrast, Perceived Risk ($\beta = -0.108$) demonstrated a significant negative influence.

11. Theoretical Contributions

1. Integrates TAM, UTAUT, and Risk-Benefit Theory.
2. Extends adoption research toward risk management.
3. Validates FinTech adoption behavior in public sector banking.
4. Provides an empirically supported framework for digital banking sustainability.

12. Practical Implications

Public sector banks should:

- Improve application usability.
- Enhance customer awareness programs.
- Implement AI-driven fraud detection systems.
- Utilize behavioral analytics for risk monitoring.
- Strengthen cybersecurity mechanisms.

13. Conclusion

This study develops and validates an integrated FinTech Adoption and Real-Time Risk Assessment Framework for public sector banks. The findings reveal that social influence, perceived benefits, perceived ease of use, and perceived usefulness significantly enhance customer attitudes toward FinTech adoption, whereas perceived risk remains a barrier. The proposed framework bridges the gap between technology adoption and transaction risk management, offering strategic insights for policymakers, banking institutions, and FinTech service providers. Future research may incorporate machine learning and blockchain-based risk prediction models to further improve banking resilience.

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