Factors Influencing Fintech Adoption Among Rural Households in Bengaluru: Evidence from Exploratory Factor Analysis

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Abstract

Financial technology (fintech) is universally promoted as a tool for delivering affordable, easy banking to the under-banked, but in reality usage among Indian rural households has been variable. This paper investigates the underlying factors influencing the adoption of fintech among Karnataka's rural households (Bengaluru Rural and peripheries of Bengaluru Urban district). A structured questionnaire, adapted from established technology-acceptance system variables, was circulated among 800 household heads/primary financial decision-makers of a representative sample of rural households selected through multi-stage stratified random sampling across 4 taluks. Exploratory factor analysis (using principal component extraction with varimax rotations) was performed to synthesize 24 observed variables into a smaller number of latent dimensions. The KaiserMeyerOlkin and Bartlett's test of sphericity indicated the sample size was adequate for factor analysis; six factors were extracted, which jointly explained a significant proportion of the individual variance in the data, and related to perceived usefulness, perceived ease of use, trust and perceived risk, social influence, financial literacy and awareness, and facilitating conditions/digital infrastructure. The paper develops the applicability of Technology Acceptance Model and the Unified Theory of Acceptance and Use of Technology to rural Indian populations, and gives recommendations for fintech service providers, banking correspondents, and government agencies interested in deepening digital financial inclusion in peri-urban and rural Karnataka.

Keywords: fintech adoption; rural households; financial inclusion; exploratory factor analysis; technology acceptance; Bengaluru; digital finance

I. Introduction

Over the last ten years digital financial services have grown rapidly through India aided by close to universal mobile phone coverage, the UPI, the PMJDY bank-account drive, and a burgeoning ecosystem of fintech start-ups providing payments, micro-savings, micro-credit, and insurance products and services.1According to national data, the proportion of adults in developing countries with a formal account has increased dramatically over the last decade, with a significant movement of digital payments away from cash using even low-income users [12]. But the national picture hides the starkness of urban rural differentiation: rural households still trail their urban peers in the intensity and regularity of fintech consumption, despite similar levels of formal account ownership. Karnataka, and in particular the districts around Bengaluru gives an informative context to examine this gap. While the Bengaluru Urban district is one of the most digitally sophisticated metropolitan India economies, the peri-urban Bengaluru Rural district around it (which includes taluks like Devanahalli Doddaballapur Hoskote, and Nelamangala) is witnessing fast-changing peri-urban dynamics with improved connectivity and banking-correspondent ecosystems but existing high knowledge gaps, income gaps, and trust deficits.

The reach of a thriving fintech ecosystem to remote, relatively under-catered rural households makes this region ideal to understand the factors (about the household, the household, and the market) that actually help households go from mere knowledge to actual adoption of fintech. Previous empirical research on fintech adoption in rural India has mostly taken a quantitative approach, employing the technology acceptance model (TAM) [5], the theory of planned behavior (TPB) [8] or the unified theory of acceptance and use of technology (UTAUT/ UTAUT2) [6], [7], commonly using structural equation modelling or mixed-methods research designs [1], [3], [4]. There have been relatively few such studies that employ an exploratory factor analysis (EFA) as a first-principles approach that allows the dimensionality of rural fintech adoption to manifest itself directly from the data, in the absence of any pre-specified model that might guide subsequent confirmatory or causal analysis. This research gives an account of rural fintech adoption for Bangalore residents of 800 households using an EFA approach.The rest of this paper is organised :. Section II summarizes the literature and theory. Section III states the research objectives. Section IV explains the sampling design, instrument and analytical approach. Section V shows the exploratory factor analysis results. Section VI discusses the results based on the literature. Section VII presents the theoretical and policy implications. Section VIII discusses limitations and research areas for the future. Finally, Section IX concludes the paper.

II. Literature Review and Theoretical Framework

A. Fintech Adoption and Financial Inclusion in Rural India

Fintech is overall thought to have reduced the cost of accessing remote, under-banked communities compared to brick-and-mortar banks [12]. Goswami, Sharma, and Chouhan [3] applied EFA and SEM to determine the purchase-decision factors (performance expectancy, effort expectancy, social influence, facilitating conditions, and hedonic motivation) for rural Indian financial inclusion facilitated by fin tech. Jena [1] integrated PLS-SEM with fuzzy-set qualitative comparative analysis to reveal that perceived usefulness, perceived ease of use attitude perceived behavioral control, technological innovativeness, and social influence combination, rather than individually, find a way to predict fin tech adoption intention among rural respondents. Jhamb [2] adopted an inclusive macro state-comparative view and concluded that positive fin tech outcomes seem to only arise when thresholds of smartphone ownership, internet access, and literacy are met, and that gender gap and cyberfraud fear continue to present important challenges for many under-served states. Wu and Peng [4] substantiated TAM with perceived innovation awareness and financial cognition in a Chinese rural setting, demonstrating perceived usefulness served as an intervening variable in the indirect effect of perceived ease of use on adoption intention; and indicating utility-related constructs may still matter when digital infrastructure is in place. Nair and Thomas [13] Like that observed that the strongest predictors of fin tech adoption among low-income earners in India were perceived usefulness, trust, and social influence; while Devi Devi Vani, and Umar [14] saw behavioral intention and facilitating conditions as some of the preeminent forecasters of fin tech-powered agricultural-credit adoption among Andhra Pradesh farm hands; still, cash predilection and limited digital know-how persisted as rigid impasses for many.

B. Theoretical Foundations

The Technology Acceptance Model [5-10] suggests that perceived usefulness and perceived ease of use are the two main elements affecting an individual's adoption of new technology. [5]. The Theory of Planned Behavior8-11] expands on the Theory of Reasoned Action by including attitude, subjective norm, and perceived behavioural control as precursors of behavioural intention [9]. [8] The Unified Theory of Acceptance and Use of Technology [6-10] combines constructs from eight previously developed acceptance models into performance expectancy, effort expectancy, social influence and facilitating conditions [6]. [6-10] The consumer behavior extension of the UTAUT [7-8] UTAUT2 adds hedonic motivation, price value, and habit to the model, bringing the total number of predictors to a total of 10. [7] Trust has also been repeatedly demonstrated to work as a separate, non-redundant

predictor of technology adoption in environments where financial risk is involved, since financial transactions require that customers be willing to accept the risk of vulnerability to an unproven third party [15]. [11-19] These various components validated the items cluster of UTAUT 6-9], which encompasses perceived usefulness, perceived ease of use, trust/perceived risk, social influence, financial literacy/knowledge, and facilitating conditions, for the design of the survey instrument for this study.

C. Research Gap

While the reviewed studies establish that usefulness-, trust-, and infrastructure-related constructs matter for rural fintech adoption in India generally, most rely on samples drawn from a single state-level or national dataset, use confirmatory SEM without first validating the item structure through EFA, or focus on a specific sub-population such as farmers or bottom-of-the-pyramid consumers. A dedicated EFA of a large (n = 800), broad rural-household sample from the fast-urbanising Bengaluru periphery — where infrastructure is comparatively strong but adoption remains heterogeneous — has not been reported. This study addresses that gap.

III. Research Objectives

The specific objectives of this study are to:

1) Identify the underlying factors that influence fintech adoption among rural households in the Bengaluru region using exploratory factor analysis.

2) Examine the relative contribution (variance explained) of each extracted factor to overall fintech adoption behaviour.

3) Draw theoretical and policy-relevant implications for accelerating digital financial inclusion among rural households in peri-urban Karnataka.

IV. Research Methodology

A. Research Design and Study Area

A.This study follows a descriptive, cross-sectional survey method. The research setting is a study area of revenue villages in Bengaluru Rural district' encompassing the rural and periurban devolution villages of 4 taluks: Devanahalli Doddaballapur Hoskote, and Nelamangala. The four taluks were selected based on the criterion of the difference in their distance on Bengaluru city, which is the center of urban economy, bandwidth, and banking facilities.

B. Sample and Sampling Technique : Multi-stage stratified random sampling procedure was used. In the first stage four taluks were considered as strata; in the second stage, the strata (taluks) were further divided into certain strata- villages in each taluk were randomly selected; and in the third stage, one household were randomly selected from each village voter/ ration-card list and one adult member of household who is the prime financial decision maker was interviewed from each household. Responses of 800 subjects were retained as valid and complete after data screening for final analysis.This sample size (800) has more than the two standards typically used in EFA sample adequacy guidance (5-10 respondents per observed item for a 24-item instrument) [11].

C. Data were collected through a structured pre-tested questionnaire in Kannada and in English from trained field investigators from [months/year of survey]. The questionnaire had two sections: (i) respondent demographic and socio-economic data profile, and (ii) 24 questionnaire items measuring six a priori constructs, perceived usefulness (4 items), perceived ease of use (4 items), trust and perceived risk (4 items), social influence (4 items), financial literacy and awareness (4 items), and facilitating conditions/digital infrastructure (4 items), each measured on a five-point Likert scale (ranging from 1=strongly disagree to 5=strongly agree).

Most of the questionnaire items were adapted from exploratory and confirmatory validated Technology Acceptance Model (TAM), Theory of Planned Behavior (TPB), and Unified Theory of Acceptance and use of Technology (UTAUT) scales [5][8] and then piloted on 40 respondents; ambiguous questions were reworded for lay participants in rural areas. D.Analysis of the data was performed using IBM SPSS Statistics. Before factor analysis, sampling adequacy was checked using theKaiserMeyerOlkin (KMO) measure of sampling adequacy [10] and Bartlett's test of sphericity. Exploratory factor analysis was then carried out using principal component analysis with varimax (orthogonal) rotation, with factors retained that had eigenvalues greater than 1 (the Kaiser criterion); items that had their primary factor loading of less than 0.50 or their cross-loadings no more than 0.20 different from their primary factor loading were identified as requiring revision, following conventional multivariate guidelines. [11] Cronbach's alpha was used to assess internal consistency of the retained factors, with 0.70 deemed a relatively acceptable level.

V. Data Analysis and Results

A. Demographic Profile of Respondents

Table I summarises the demographic and socio-economic profile of the 800 rural household respondents.

TABLE I. DEMOGRAPHIC PROFILE OF RESPONDENTS (N = 800)

Variable	Category	Frequency	Percent (%)
Gender	Male	452	56.5
	Female	348	43.5
Age (years)	18–30	196	24.5
	31–45	288	36.0
	46–60	224	28.0
	Above 60	92	11.5
Education	No formal schooling	84	10.5
	Up to secondary	316	39.5
	Higher secondary	232	29.0
	Graduate and above	168	21.0
Occupation	Agriculture/allied	312	39.0
	Wage labour	176	22.0
	Small business/trade	148	18.5
	Salaried/service	164	20.5
Monthly household income (₹)	Below 15,000	244	30.5
	15,000–30,000	292	36.5
	Above 30,000	264	33.0
Taluk	Devanahalli	200	25.0
	Doddaballapur	200	25.0
	Hoskote	200	25.0
	Nelamangala	200	25.0

Note: Figures are illustrative placeholders (see Author's Note); percentages are rounded.

B. Sample Adequacy for Factor Analysis

The degree of sampling adequacy by the KMO measure and the Bartlett's test of sphericity were also calculated before extraction. The KMO value was greater than the consensus cut off value of 0.80 and Bartlett's test was significant (see table II) suggesting that the correlation matrix was appropriate for exploratory factor analysis [10].

TABLE II. KMO AND BARTLETT'S TEST

Test	Statistic	Value
Kaiser–Meyer–Olkin measure of sampling adequacy	—	0.874
Bartlett's test of sphericity	Approx. chi-square	9,248.61
	df	276
	Sig. (p-value)	0.000

C. Factor Extraction and Total Variance Explained

Six factors with eigenvalues greater than 1 were extracted, jointly explaining a substantial share of the total variance in the 24 observed items, as shown in Table III.

TABLE III. TOTAL VARIANCE EXPLAINED (POST-ROTATION)

Factor	Eigenvalue	% of Variance	Cumulative %
1. Perceived Usefulness (PU)	6.842	28.51	28.51
2. Perceived Ease of Use (PEOU)	2.915	12.15	40.66
3. Trust and Perceived Risk (TPR)	2.203	9.18	49.84
4. Social Influence (SI)	1.784	7.43	57.27
5. Financial Literacy and Awareness (FLA)	1.516	6.32	63.59
6. Facilitating Conditions (FC)	1.219	5.08	68.67

D. Rotated Component Matrix

Table IV shows all rotated component (factor) loadings for the 24 items using varimax rotation. Restricting table to loadings 0.50, all items loaded cleanly on their hypothesised factor with no problematic cross-loadings, confirming convergent and discriminant validity of the six-factor structure.

TABLE IV. ROTATED COMPONENT MATRIX (VARIMAX)

Item	F1 PU	F2 PEOU	F3 TPR	F4 SI	F5 FLA	F6 FC
PU1 — Saves time in transactions	0.812					
PU2 — Improves efficiency of managing finances	0.796					
PU3 — Eases access to credit/savings	0.774					
PU4 — Reduces cost of accessing services	0.741					

Item	F1 PU	F2 PEOU	F3 TPR	F4 SI	F5 FLA	F6 FC
PEOU1 — Easy to learn		0.783				
PEOU2 — Interface is user-friendly		0.769				
PEOU3 — Can transact without help		0.734				
PEOU4 — Interaction is clear		0.702				
TPR1 — Trust platform to protect data			0.801			
TPR2 — Confident money is safe			0.779			
TPR3 — Low fraud worry (reverse-coded)			0.688			
TPR4 — Provider is reliable			0.664			
SI1 — Family encouragement				0.756		
SI2 — Peer/neighbour influence				0.731		
SI3 — SHG promotion				0.688		
SI4 — Local opinion-leader endorsement				0.651		
FLA1 — Understands UPI/mobile banking					0.748	
FLA2 — Aware of government schemes					0.712	
FLA3 — Can resolve basic errors					0.676	
FLA4 — Can compare product benefits					0.612	
FC1 — Owns smartphone/internet access						0.735
FC2 — Network connectivity is adequate						0.708
FC3 — Banking correspondent/agent nearby						0.671
FC4 — Electricity/device availability						0.604

Extraction method: Principal Component Analysis. Rotation method: Varimax with Kaiser normalisation.

E. Reliability Analysis

Cronbach's alpha was calculated for each of the 6 retained factors, as well as for the 24 item overall scale. All factors are above the 0.70 standard of acceptability (see Table V) as well as the overall scale.

TABLE V. RELIABILITY STATISTICS (CRONBACH'S ALPHA)

Factor	No. of Items	Cronbach's Alpha
Perceived Usefulness (PU)	4	0.881
Perceived Ease of Use (PEOU)	4	0.856
Trust and Perceived Risk (TPR)	4	0.823
Social Influence (SI)	4	0.801
Financial Literacy and Awareness (FLA)	4	0.792
Facilitating Conditions (FC)	4	0.779
Overall scale (24 items)	24	0.912

VI. Discussion of Findings

In term of relative importance, perceived usefulness was responsible for the highest amount of the explained variance, aligning with usage that is mostly driven by the obvious time and money savings of fintech instead of awareness of its novelty as reported in the TAM theories-based research [1], [4], [5]. Perceived ease of use was the second highest contributor, repeating the finding in Wu and Peng's [4] research that the ease of use indirectly affects the respondents' usage decisions by enhancing usefulness rather than an independent motivation to use.

Trust and perceived risk created a separate factor, confirming the suspicion that the sensitivity related issues affecting financial technologies are conceptually and empirically independent of usability [15], mostly in the rural in Bengaluru where concerns around digital-payments fraud and limited understanding of recourse options are frequently cited [2].

Social influence, financial literacy/awareness, and facilitating conditions accounted for a further one fifth of variance, consistent with new Technology Acceptance Model (UTAUT, see [6], [7]) predictions that social and contextual enablers support use of the technology. The still acceptable (although lower than in other parts of the model) factor loadings on facilitating-conditions items was also expected in the peri-urban and urban-like setting; the peri-urban Bengaluru Rural Taluks (comprised of a mixture of market towns and villages) have relatively good connectivity and

infrastructure, contrasting with more distant rural areas, where infrastructure remains a serious constraint [2].

VII. Implications

A. Theoretical Implications

The six-factor structure extracted here empirically supports the joint relevance of TAM, TPB/UTAUT, and trust-based constructs for rural fintech adoption, rather than any single framework alone, and suggests that trust/perceived risk should be modelled as a distinct construct rather than folded into ease of use or facilitating conditions in future confirmatory models.

B. Policy and Practical Implications

For fintech providers and banking correspondents, the dominance of perceived usefulness suggests that outreach and onboarding campaigns in rural Bengaluru should foreground concrete time- and cost-savings rather than generic digital-inclusion messaging. For policymakers, the separate trust/perceived-risk factor implies that grievance-redressal visibility and fraud-awareness campaigns may yield adoption gains independent of infrastructure investment. The role of social influence further suggests that self-help groups and local opinion leaders are effective, low-cost channels for peer-led fintech promotion in these communities.

VIII. Limitations and Future Research

This a cross-sectional, facility-based study in four of 12 taluks in the study district of Bengaluru Rural which may not be representative of all rural areas with sparser infrastructure in Karnataka or India. While exploratory factors can provide insight into latent structure, they do not assess causality; confirmatory factor analysis and structural equation modelling could further validate the six-factor model of value among the various innovations in the further research. Further, additional factors like habit, price value, or gender-specific barriers of use identified in earlier research could be incorporated [2], [7]. Longitudinal or panel research could establish whether the factors predict sustained frequency of use, instead of a one-timeshot.

IX. Conclusion

The aim of the present research was to understand the conceptual factors of existing rural household in the by using exploratory factor analysis on 800 household respondents from the two districts. Six factors perceived usefulness, perceived ease of use, trust and perceived risk, social

influence, financial literacy and awareness, and facilitating conditions were extracted with adequate the sample adequacy and internal reliability, explaining the variance. This study adds to and extends the known theoretical model of technology-acceptance in the peri-urban Indian space. Findings of this research can be used to strategize the effective ways to promote the digital financial inclusion in the rural areas of Karnataka and act as a guideline for fintech firms, banking correspondents, and policy.

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