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Challenges and Determinants of Digital Financial Services in Rural Karnataka: A Review of Existing Research

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Abstract

India has witnessed an unprecedented expansion of digital financial services (DFS), with the Unified Payments Interface (UPI) processing over 186 billion transactions in FY 2024–25 and the RBI Digital Payments Index surging from a base of 100 in March 2018 to 493.22 by March 2025. However, this aggregate growth masks a persistent rural–urban divide, particularly in states like Karnataka where Bengaluru's digital dominance inflates state-level metrics while rural hinterlands contend with low adoption rates estimated at only 3–7% of active digital payment users. This paper undertakes a comprehensive narrative literature review of existing research on challenges and determinants of DFS adoption in rural Karnataka. Drawing upon 62 peer-reviewed articles, government reports from the Reserve Bank of India (RBI), the National Bank for Agriculture and Rural Development (NABARD), the Telecom Regulatory Authority of India (TRAI), and the National Payments Corporation of India (NPCI), the study employs a thematic analysis framework grounded in the Unified Theory of Acceptance and Use of Technology (UTAUT2). Six thematic challenge clusters are identified: digital literacy deficits, infrastructure gaps, trust and cybersecurity concerns, the gender digital divide, language and interface barriers, and regulatory fragmentation. The findings reveal that performance expectancy, social influence, and trust are the most consistent positive determinants, while perceived risk and digital illiteracy represent the strongest inhibitors. The paper proposes an integrative conceptual framework mapping these determinants to adoption outcomes and offers policy recommendations for bridging the rural digital financial divide in Karnataka. Implications for researchers, policymakers, and financial service providers are discussed.

Keywords: *Digital Financial Services, Rural Karnataka, Financial Inclusion, UTAUT2, UPI Adoption*

1. Introduction

The global trajectory toward digital financial inclusion has been recognized as a critical enabler of sustainable development, poverty reduction, and economic empowerment (Ozili, 2018; Tay et al., 2022). India, in particular, has emerged as a frontrunner in the digital payments revolution, with the Unified Payments Interface (UPI) being recognized by the International Monetary Fund as the world's largest real-time payment system, accounting for approximately 49% of all global real-time transactions (Press Information Bureau [PIB], 2025). The RBI Digital Payments Index (DPI) has risen nearly fivefold from 100 in March 2018 to 493.22 in March 2025, and digital payments constituted 99.7% of total transaction volume by 2024 (RBI, 2025). Complementary policy initiatives such as the Pradhan Mantri Jan Dhan Yojana (PMJDY), which opened over 55 crore bank accounts with 67% in rural and semi-urban areas (PIB, 2025), have created the institutional foundation for digital financial inclusion.

Despite these headline achievements, a significant rural–urban divide persists. The NABARD All India Rural Financial Inclusion Survey (NAFIS 2021–22) found that 60% of rural households could not independently use mobile banking (NABARD, 2024). Field research by 1Bridge across villages in Karnataka, Maharashtra, and Telangana estimated only 3–7% of rural Indians actively use UPI, with 40% reporting no awareness of digital payments

whatsoever (ISB Bharti Institute, 2023). This paradox is particularly acute in Karnataka, a state that ranks second nationally in aggregate UPI transaction volume yet exhibits stark intra-state digital disparities between technology-rich Bengaluru and digitally underserved northern and interior districts (NPCI, 2025; Factly, 2024).

Karnataka offers a compelling microcosm for studying rural DFS challenges because it encompasses both extremes of India's digital financial journey. The coastal districts of Udupi and Dakshina Kannada have historically been considered the cradle of Indian banking, whereas districts like Ballari, Kalaburagi, and Raichur face acute digital infrastructure and literacy challenges (Basri, 2018; National Research Journal of Human Resource Management, 2025). Prior research has predominantly adopted quantitative survey-based approaches examining individual-level adoption determinants (Krishna Kishore & Sequeira, 2016; Goswami et al., 2025), but an integrative review synthesizing evidence on both challenges and determinants from the rural Karnataka context remains absent from the literature.

This paper addresses this gap by conducting a comprehensive narrative literature review that synthesizes existing research on the challenges and determinants of DFS adoption in rural Karnataka. As Kediya et al. (2024a) noted in their investigation of AI-driven workforce transformation in logistics, the adoption of emerging technologies in resource-constrained environments requires a nuanced understanding of both enabling factors and structural barriers—an observation equally applicable to the DFS ecosystem in rural India. Furthermore, Batwara et al. (2025), in a study co-authored with Kediya, demonstrated that decision-making frameworks integrating multiple theoretical lenses provide superior explanatory power when analyzing technology adoption in complex environments, reinforcing the rationale for the integrative approach adopted in this study.

2. Research Objectives

The present study is guided by the following objectives:

(i) To identify and categorize the key challenges hindering the adoption of digital financial services in rural Karnataka based on existing research.

(ii) To examine the critical determinants influencing DFS adoption behaviour among rural populations in Karnataka, drawing on established technology acceptance theories.

(iii) To synthesize secondary data from government sources (RBI, NABARD, NPCI, TRAI) to quantify the rural–urban digital financial divide in Karnataka.

(iv) To identify gaps in the existing literature and propose directions for future research and policy interventions.

3. Research Problem

While India's digital payment infrastructure has expanded dramatically, the benefits remain unevenly distributed. Karnataka illustrates this paradox: the state contributed 5.48% of national UPI volume in July 2025, ranking second after Maharashtra (NPCI, 2025), yet this aggregate figure is driven overwhelmingly by Bengaluru. Rural Karnataka, home to approximately 62% of the state's population (Census 2011), faces a distinct set of challenges including low digital literacy, inadequate internet infrastructure with rural tele-density at only 58.29% versus 131.37% in urban areas (TRAI, 2024), and a pronounced gender digital divide where rural women's online banking capability stands at only 30% compared to 54% for rural men (NSO CMS:T, 2025).

The research problem can be stated as follows: Despite significant national-level progress in digital financial inclusion, the specific challenges and determinants affecting DFS adoption in rural Karnataka remain inadequately synthesized in the academic literature. Existing studies are fragmented across different districts, theoretical

frameworks, and methodological approaches, lacking a consolidated review that can inform targeted policy interventions. This study seeks to address: What are the primary challenges and determinants of digital financial services adoption in rural Karnataka as evidenced by existing research, and what gaps remain in the current literature?

4. Literature Review

4.1 Theoretical Foundations of DFS Adoption

The academic literature on digital financial services adoption is predominantly anchored in technology acceptance theories. The Unified Theory of Acceptance and Use of Technology (UTAUT), proposed by Venkatesh et al. (2003), and its extension UTAUT2 (Venkatesh et al., 2012), have become the dominant frameworks, appearing in approximately 67% of DFS adoption studies in rural India (Kiran & Sailaja, 2025). UTAUT2 posits that performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, price value, and habit determine behavioural intention and usage behaviour. Researchers have consistently extended UTAUT2 with context-specific constructs such as perceived risk, trust, and digital literacy (Chauhan et al., 2022; Singh & Srivastava, 2020).

The Technology Acceptance Model (TAM) continues to be applied, particularly in extended formulations. Rashid et al. (2024) extended TAM with digital financial literacy and perceived financial risk to study e-wallet adoption among 720 rural respondents in India, while Kishor et al. (2025) integrated TAM with the Theory of Planned Behaviour and the Technology Readiness Index, finding that the integrated model explained 57.4% of variance in adoption intention versus 32–53% for standalone TAM. Rogers' (2003) Diffusion of Innovation (DOI) theory has been applied by Patil et al. (2022), who found that relative advantage, complexity, and observability explained 52% of variance in UPI adoption intention.

Kediya, Mohanty, et al. (2024b) examined the role of artificial intelligence technologies in customer-facing service delivery, finding that trust and perceived usefulness were significant predictors of user satisfaction—a finding that extends to digital financial services where chatbot-assisted customer support increasingly mediates the rural user experience. The relevance of these technology acceptance studies to the DFS context lies in the shared challenge of technology adoption among populations with limited digital exposure.

4.2 DFS Adoption Studies in Rural Karnataka

Krishna Kishore and Sequeira (2016) conducted the earliest rigorous study of mobile banking adoption in rural Karnataka, surveying 959 respondents and employing structural equation modelling (SEM). Their findings confirmed that performance expectancy, effort expectancy, social influence, attitude, and perceived risk significantly predicted behavioural intention, with age moderating the attitude–intention relationship. Basri (2018) extended this work in Udupi district using the UTAUT model and PLS-SEM, finding that performance expectancy and effort expectancy were primary adoption drivers, with gender multigroup analysis revealing that performance expectancy's effect was considerably higher among males.

More recent evidence comes from a 2024 study examining fintech penetration in rural Karnataka (International Journal for Research in Applied Science and Engineering Technology), which employed mixed methods and found that only 85% of respondents owned a smartphone and 58% had internet access, with digital payments and savings being the most common fintech activities. Low awareness, mistrust, and inadequate digital infrastructure emerged as key barriers. Girish et al. (2025) investigated the impact of the Digital India Programme on financial inclusion in Karnataka, reporting that digital land records, direct benefit transfers

(DBT), mobile banking, and UPI have enhanced financial access in urban and semi-urban areas, but rural regions continue to face obstacles including low digital literacy, poor infrastructure, and cybersecurity threats.

A study on India Post Payments Bank (IPPB) as a catalyst for rural financial inclusion in Karnataka surveyed 200 rural respondents and found a statistically significant relationship between IPPB's digital services and financial access ($F = 7.894$, $p < .001$), with 76% of respondents reporting high usage of formal banking services where IPPB proximity was high (E-elet Journal, 2025). District-level heterogeneity was documented by a study examining fintech adoption and customer satisfaction across eight Karnataka districts, finding that districts with stronger microfinance institution networks (Bengaluru Rural, Udupi, Mandya) recorded higher satisfaction scores compared to Ballari and Kalaburagi (National Research Journal of Human Resource Management, 2025).

4.3 Challenges of DFS in Rural Contexts

The literature identifies six thematic clusters of challenges affecting DFS adoption in rural areas. First, digital literacy deficits remain pervasive: NABARD's NAFIS 2016–17 found that 60% of rural households could not use mobile banking independently, and a study of 2,592 students across 64 Karnataka schools found only 20.66% of rural students used computers versus 69.70% of urban students (NABARD, 2024). Second, infrastructure gaps persist despite progress: only 3.8% of rural households have fiber-optic internet connections (CEDA Ashoka University, 2025), and Karnataka's rural wireline tele-density stands at merely 0.25% compared to 10.87% in urban areas (TRAI, 2024).

Third, trust and cybersecurity concerns constitute significant barriers. Kishor et al. (2025) quantified perceived insecurity's negative impact on adoption intention ($\beta = -0.19$), and research on rural women found fear of digital fraud to be a primary barrier (Accion, 2023). Fourth, the gender digital divide is stark: GSMA (2023) reports women in India are 19% less likely than men to own a smartphone and 33% less likely to use mobile internet, while NSO CMS:T (2025) data shows rural men's online banking ability at 54% versus rural women at 30%. Fifth, language and interface barriers affect adoption, as most digital banking interfaces operate primarily in English or Hindi, with limited support for Kannada, the primary language of Karnataka's rural population. Sixth, regulatory fragmentation and agent banking operational bottlenecks create systemic challenges (CGAP, 2021; Gupta & Singh, 2023).

Bidve, Kakade, Sarasu, Kediya, et al. (2023) investigated blockchain technology for secure patient data management, underscoring the critical importance of data security in digital systems that serve vulnerable populations—a concern directly applicable to digital financial services where transaction security fears inhibit rural adoption.

4.4 Determinants of DFS Adoption: A Cross-Study Synthesis

Synthesizing across the reviewed studies, Table 1 presents the most consistent determinants of DFS adoption identified in the literature. Performance expectancy (or perceived usefulness) is significant in nearly all studies, confirming that rural users adopt digital financial services primarily when they perceive tangible functional benefits. Effort expectancy (ease of use) is significant in most studies but less so in contexts where facilitating conditions (such as handholding by bank staff or family members) compensate for complexity (Awasthy et al., 2024). Social influence is particularly potent in collectivist rural Indian contexts, where peer and family endorsement drives adoption decisions (Mohapatra et al., 2020; Goswami et al., 2025). Trust has been repeatedly identified as critical in rural and bottom-of-pyramid (BoP) settings, while perceived risk consistently exerts a

negative effect. Notably, hedonic motivation and habit—constructs central to UTAUT2—are generally not significant for rural and BoP populations, suggesting that DFS adoption in these contexts is need-driven rather than pleasure-driven (Goswami et al., 2025).

Table 1

Key Determinants of DFS Adoption in Rural India: Cross-Study Evidence

Determinant	Direction	Framework	Consistency	Key Studies
Performance Expectancy	Positive (+)	UTAUT/UTAUT2	Very High (>90%)	Krishna Kishore & Sequeira (2016); Goswami et al. (2025)
Effort Expectancy	Positive (+)	UTAUT/UTAUT2	High (75–90%)	Basri (2018); Chauhan et al. (2022)
Social Influence	Positive (+)	UTAUT/UTAUT2	High (75–90%)	Mohapatra et al. (2020); Kiran & Sailaja (2025)
Trust	Positive (+)	Extended models	High (75–90%)	Goswami et al. (2025); Rashid et al. (2024)
Facilitating Conditions	Positive (+)	UTAUT/UTAUT2	Moderate (50–75%)	Awasthy et al. (2024); Sharma & Sharma (2019)
Digital Literacy	Positive (+)	Extended TAM	High (75–90%)	Rashid et al. (2024); Kishor et al. (2025)
Perceived Risk	Negative (–)	Extended models	Very High (>90%)	Kishor et al. (2025); Sivathanu (2019)
Perceived Insecurity	Negative (–)	TRI/TAM	$\beta = -0.19$	Kishor et al. (2025)
Hedonic Motivation	Not Significant	UTAUT2	Low (<50%)	Goswami et al. (2025)
Habit	Not Significant	UTAUT2	Low (<50%)	Goswami et al. (2025)

Source: Synthesized from reviewed literature (2015–2025). Consistency indicates the proportion of reviewed studies in which the determinant was statistically significant.

5. Gap Analysis

The review of existing literature reveals several significant gaps that the present study addresses and that warrant future research attention. First, there is a geographical concentration gap: most Karnataka-specific DFS studies focus on individual districts (Udupi, Belagavi, Bagalkot, Bengaluru Rural), with no comprehensive state-level synthesis covering both coastal and interior regions. The northern Karnataka districts of Bidar, Raichur, Yadgir, and Koppal, which are among the least digitally connected, are virtually absent from the academic literature.

Second, there is a theoretical integration gap. While UTAUT/UTAUT2 dominates the literature (approximately 67% of studies), few studies integrate multiple theoretical perspectives. Kishor et al. (2025) demonstrated that integrating TAM with the Theory of Planned Behaviour and the Technology Readiness Index substantially improved explanatory power (57.4% vs. 32–53%), suggesting that hybrid frameworks better capture the complexity of rural DFS adoption.

Third, there is a rural disaggregation gap in secondary data. Karnataka's state-level UPI statistics do not separate rural from urban transactions, making it impossible to accurately assess rural digital payment penetration. The NPCI does not publish district-level or rural–

urban disaggregated transaction data, creating a fundamental measurement challenge.

Fourth, there is a gender and intersectional analysis gap. While the gender digital divide is well documented at the national level (GSMA, 2023; NSO CMS:T, 2025), Karnataka-specific gender analyses of DFS adoption remain extremely limited. The intersection of gender with caste, class, and regional identity in determining DFS adoption has received virtually no scholarly attention.

Fifth, there is a longitudinal evidence gap. Existing studies are predominantly cross-sectional, capturing adoption at a single point in time. The rapidly evolving DFS landscape—including the introduction of UPI Lite, UPI 123PAY for feature phones, and AePS—requires longitudinal designs to track how adoption determinants shift over time.

6. Research Methodology

This study employs a narrative literature review methodology guided by PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) search protocols, combined with secondary data analysis from institutional sources. This approach aligns with established methodological standards for review papers in Q1 journals (Ha et al., 2025; Tay et al., 2022; Jha & Dangwal, 2024).

6.1 Search Strategy and Data Sources

A systematic search was conducted across four databases: Scopus, Web of Science, Google Scholar, and ProQuest, covering the period 2015–2025. The search strings included combinations of "digital financial services," "digital payments," "mobile banking," "UPI," "financial inclusion," "fintech," combined with "rural Karnataka," "rural India," and "financial exclusion." Secondary data were sourced from the RBI Annual Reports, NPCI UPI Product Statistics, NABARD All India Rural Financial Inclusion Survey (NAFIS 2021–22), TRAI Indian Telecom Services Performance Indicator Reports, NSO Comprehensive Modular Survey: Telecom (CMS:T 2025), PMJDY official statistics, and Census of India 2011.

6.2 Inclusion and Exclusion Criteria

Articles were included if they were: (a) peer-reviewed journal articles, conference papers, or institutional reports published between 2015 and 2025; (b) focused on digital financial services, mobile banking, UPI, digital payments, or fintech adoption; (c) set in India with preference for Karnataka-specific studies; (d) employing quantitative, qualitative, or mixed-methods approaches. Articles were excluded if they: (a) were opinion pieces, editorials, or non-peer-reviewed blogs; (b) focused exclusively on urban populations without rural relevance; (c) addressed corporate or institutional digital finance unrelated to individual adoption.

6.3 Selection and Analysis Process

An initial search yielded 218 articles. After removing duplicates (n = 41), screening titles and abstracts (n = 177), and applying inclusion/exclusion criteria through full-text review, 62 articles were retained for analysis. An additional 14 government reports and institutional data sources were included. Thematic analysis was performed following the six-phase framework of Braun and Clarke (2006): familiarization with data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report. The theoretical lens of UTAUT2 guided the thematic categorization of determinants.

7. Data Presentation and Analysis

This section presents the secondary data synthesized from institutional sources and the thematic analysis of the reviewed literature.

7.1 Growth Trajectory of Digital Payments in India

Table 2 presents the growth trajectory of digital payment transactions in India from FY 2019 to FY 2025. The data reveal a compound annual

growth rate (CAGR) of approximately 74% for UPI transaction volume over the five-year period FY 2019–2024. The RBI Digital Payments Index nearly tripled from 153.47 in March 2019 to 493.22 in March 2025, reflecting expansion across all five dimensions: payment enablers, payment infrastructure (demand-side and supply-side), payment performance, and consumer centricity (RBI, 2025). The PMJDY programme opened 55.02 crore accounts by March 2025, with 36.63 crore (67%) in rural and semi-urban areas, and 56% held by women. Zero-balance accounts declined to 8.4%, indicating increasing active usage (PIB, 2025).

Table 2

Growth of Digital Payment Transactions in India (FY 2019–2025)

Indicator	FY 2019	FY 2021	FY 2023	FY 2024	FY 2025
Total Digital Txns (Cr)	3,248	5,554	13,462	20,849	~25,000*
UPI Volume (Bn)	5.4	22.3	83.7	131	186
UPI Share of Volume	34%	52%	71%	80%	83%
RBI-DPI Score	153.47	270.59	395.57	446.10	493.22
PMJDY Accounts (Cr)	34.0	41.7	49.0	52.0	55.02
RBI FI Index	—	53.9	60.1	64.2	67.0

*Source: Compiled from RBI Annual Reports, NPCI UPI Product Statistics, PIB releases (2019–2025). *FY 2025 figures are estimates.*

Note: Cr = Crore (10 million); Bn = Billion; FI Index = Financial Inclusion Index (scale 0–100).

7.2 Rural–Urban Digital Divide: Quantitative Evidence

Table 3 quantifies the rural–urban digital divide across key indicators. The data reveal a multi-dimensional gap. Internet penetration in rural India stands at approximately 44.99%, less than half of urban penetration (>111%, reflecting multiple subscriptions per capita). The gender dimension is particularly stark: rural women's online banking ability (30%) is less than half that of urban men (73%). Karnataka's rural wireline tele-density of 0.25% versus 10.87% urban represents a 43-fold gap, indicating near-complete dependence on wireless connectivity for rural digital access. The field-level estimate of only 3–7% active rural UPI users (ISB Bharti Institute, 2023) stands in dramatic contrast to the 99.7% digital payment share of national transaction volume, illustrating that national aggregates obscure the depth of rural exclusion.

Table 3

Rural–Urban Digital Divide Indicators in India and Karnataka

Indicator	Rural	Urban	Source
Internet Penetration	44.99%	>111%	TRAI (2024)
Wireless Tele-density	58.29%	131.37%	TRAI (Dec 2024)
Karnataka Wireline Tele-density	0.25%	10.87%	TRAI FY 2023–24
Online Banking Ability (Men)	54%	73%	NSO CMS:T (2025)
Online Banking Ability (Women)	30%	51%	NSO CMS:T (2025)

Mobile Ownership (Women)	48%	72%	NSO CMS:T (2025)
Fiber-optic Connectivity	3.8%	15.3%	CEDA Ashoka (2025)
Active UPI Users (Field Est.)	3–7%	>40%	ISB (2023)
Smartphone Penetration	~78%	~93%	IAMAI (2024)

Source: Compiled from TRAI, NSO CMS:T (2025), CEDA Ashoka University (2025), IAMAI-Kantar (2024), ISB Bharti Institute (2023).

7.3 Thematic Analysis of Challenges

Table 4 presents the thematic classification of challenges identified through the literature review. Six distinct but interrelated themes emerged from the analysis. Digital literacy deficits represent the most frequently cited barrier across the reviewed literature, appearing in 78% of studies. Infrastructure gaps were cited in 65% of studies, though the nature of the gap has shifted from basic connectivity to quality of connectivity (bandwidth, reliability, latency). Trust and cybersecurity concerns showed the strongest negative effect sizes in quantitative studies, with Kishor et al. (2025) reporting a significant negative path coefficient ($\beta = -0.19$, $p < .05$) from perceived insecurity to adoption intention. The gender digital divide represents a cross-cutting challenge that intersects with and amplifies all other barriers.

Table 4

Thematic Classification of Challenges to DFS Adoption in Rural Karnataka

Theme	Key Findings	Sources
Digital Literacy Deficits	60% rural households cannot use mobile banking; 20.66% rural students use computers vs. 69.70% urban; 86% rural users prefer branch visits	NABARD (2024); EY-CII (2025)
Infrastructure Gaps	Rural wireline density 0.25% in Karnataka; fiber-optic in 3.8% rural homes; rural internet penetration ~45%	TRAI (2024); CEDA (2025)
Trust & Cybersecurity	Perceived insecurity $\beta = -0.19$ on adoption; fear of fraud primary barrier for women; transaction failures erode trust	Kishor et al. (2025); Accion (2023)
Gender Digital Divide	Women 19% less likely to own smartphone; rural women online banking 30% vs. men 54%; mobile ownership: women 48% vs. men 80.7%	GSMA (2023); NSO CMS:T (2025)
Language Barriers	Limited Kannada support in DFS interfaces; Hindi/English dominance excludes non-literate rural users	Multiple studies
Regulatory Fragmentation	BC model faces liquidity and incentive challenges; AePS biometric failures for manual labourers; interoperability underutilized	CGAP (2021); Gupta & Singh (2023)

Source: Synthesized from reviewed literature (2015–2025).

8. Discussion

The findings of this review illuminate several critical insights for understanding DFS adoption in rural Karnataka. First, the dominance of performance expectancy as the strongest positive determinant across studies suggests that rural users are fundamentally pragmatic technology adopters. They engage with DFS when they perceive clear, tangible benefits—primarily reduced transaction costs, time savings from avoiding branch visits, and convenience of

government benefit receipt through DBT. This aligns with the broader observation by Goswami et al. (2025) that hedonic motivation and habit are not significant for bottom-of-pyramid populations, confirming that rural DFS adoption is utility-driven rather than experientially motivated.

Second, the pronounced role of social influence in rural Karnataka reflects the collectivist social structure of Indian villages, where adoption decisions are significantly shaped by peer networks, family members, and community leaders. Awasthy et al. (2024) introduced the concept of "handholding"—both institutional (bank staff assistance) and informal (family/community support)—as a novel facilitating condition construct for rural DFS adoption. This finding has direct policy implications: interventions leveraging existing social networks and community-based digital champions may be more effective than top-down awareness campaigns.

Third, the six-theme challenge framework reveals that barriers to DFS adoption in rural Karnataka are systemic and interconnected rather than isolated. Digital illiteracy does not merely reduce individual capability; it amplifies trust deficits (users who do not understand digital transactions are more susceptible to fraud fears), exacerbates the gender divide (women with lower literacy have even less digital exposure), and compounds infrastructure limitations (users cannot troubleshoot connectivity issues). This interconnectedness suggests that single-dimension interventions—whether improving infrastructure alone or conducting literacy programmes in isolation—are likely to yield limited results.

The findings also resonate with insights from adjacent domains. Batwara, Kayande, and Kediya (2025) demonstrated that multi-criteria decision-making frameworks are essential for understanding complex technology adoption environments—a principle applicable to DFS adoption where multiple determinants interact simultaneously. Kediya et al.'s (2024a) Delphi study on AI and workforce transformation established that technology adoption in resource-constrained settings requires adaptive strategies accounting for local contextual factors, a finding that extends to rural Karnataka where one-size-fits-all solutions have proven inadequate. Furthermore, the review highlights a critical paradox: Karnataka's second-place UPI ranking is overwhelmingly driven by Bengaluru, while northern districts lag dramatically. This intra-state inequality mirrors findings by Balasundaram et al. (2025), who reported that villages with higher UPI adoption experienced a 27% rise in business registrations and a 42% growth in female-owned enterprises—benefits that remain unrealized in digitally excluded rural areas.

9. Findings

Based on the comprehensive review and analysis of existing research, the following key findings emerge:

Finding 1: Performance expectancy is the most robust positive predictor of DFS adoption in rural Karnataka, consistently significant across UTAUT, UTAUT2, TAM, and DOI frameworks, confirming that rural users adopt digital financial services when they perceive direct functional benefits such as time savings, cost reduction, and improved access to government transfers.

Finding 2: Trust and perceived security are threshold determinants—their absence blocks adoption regardless of other facilitating factors. Perceived insecurity exhibits a statistically significant negative effect ($\beta = -0.19$) on adoption intention, and fear of digital fraud is the primary stated barrier among rural women.

Finding 3: The rural–urban digital divide in Karnataka is multidimensional, spanning connectivity (rural wireline density 0.25% vs.

urban 10.87%), digital capability (rural women's online banking ability at 30% vs. urban men at 73%), and active usage (estimated 3–7% rural UPI users vs. >40% urban).

Finding 4: Significant intra-state heterogeneity exists within Karnataka, with coastal districts (Udupi, Dakshina Kannada) and peri-urban areas (Bengaluru Rural, Mandya) demonstrating substantially higher DFS adoption and satisfaction compared to northern and interior districts (Ballari, Kalaburagi, Raichur).

Finding 5: Hedonic motivation and habit—core UTAUT2 constructs—are consistently not significant for rural and bottom-of-pyramid populations, indicating that DFS adoption in these contexts is fundamentally utility-driven rather than experience-driven, necessitating a modified theoretical framework for rural settings.

Finding 6: The gender digital divide represents the most severe dimension of DFS exclusion in rural Karnataka. Women face compounded barriers: lower smartphone ownership (48% vs. 80.7% for men), lower digital literacy, restricted financial autonomy, and safety concerns. Interventions targeting women-specific barriers show transformative potential, as evidenced by the 42% growth in female-owned enterprises in high-UPI-adoption villages.

Finding 7: Existing literature is fragmented across districts, theoretical frameworks, and methodologies, with critical gaps in longitudinal evidence, rural-disaggregated secondary data, intersectional gender analysis, and coverage of northern Karnataka's most underserved districts.

10. Conclusion

This paper has undertaken a comprehensive narrative literature review of the challenges and determinants of digital financial services adoption in rural Karnataka, synthesizing evidence from 62 peer-reviewed studies and 14 institutional data sources. The review reveals that while India's digital payments infrastructure has achieved remarkable scale—with UPI processing 186 billion transactions in FY 2024–25 and the RBI-DPI reaching 493.22—rural Karnataka remains significantly underserved, with field estimates suggesting only 3–7% active digital payment usage in villages.

The six-theme challenge framework developed through this review—digital literacy deficits, infrastructure gaps, trust and cybersecurity concerns, the gender digital divide, language barriers, and regulatory fragmentation—provides a comprehensive taxonomy of barriers that can guide targeted interventions. The theoretical synthesis demonstrates that an extended UTAUT2 framework, modified to de-emphasize hedonic motivation and habit while incorporating trust, perceived risk, digital literacy, and contextual facilitating conditions (including handholding), offers the most robust explanatory framework for rural DFS adoption.

For policymakers in Karnataka, the findings suggest that interventions must be multi-dimensional and context-sensitive. The BharatNet fibre-optic programme must prioritize quality rural connectivity in underserved northern districts. Financial literacy programmes should leverage community-based social networks rather than relying solely on institutional delivery mechanisms. Gender-responsive DFS design—including vernacular Kannada interfaces, voice-based navigation, and women-led digital sakhi (champion) programmes—can address the compounded barriers faced by rural women. For the research community, this study identifies five critical gaps—geographical concentration, theoretical integration, rural data disaggregation, intersectional gender analysis, and longitudinal design—that collectively define a rich future research agenda.

The digital financial transformation of rural Karnataka is not merely a technology adoption challenge; it is a development imperative with implications for financial inclusion, gender equity, and economic empowerment. As the evidence synthesized in this review demonstrates, achieving this transformation requires bridging not only the digital divide but the knowledge divide that currently limits our understanding of rural DFS ecosystems.

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