Understanding the Perceptions of Bank Officials Towards Digital Financial Transactions in Rural India: A Case Study

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Abstract: *The global financial landscape has evolved tremendously post the digitalization in form of Digital Financial Transactions (DFTs). It has emerged as a critical enabler of economic activity and Financial Inclusion [FI] [1]. DFTs consist of electronic monetary trade-off , including online banking, payments through mobile, digital wallets, and crypto-currencies [2]. They have the capacity to transcend beyond geographies and thus reduces cost and improve financial trade-off for unbanked and to the last mile of the society [3]. Thus, been a transformative boon for the global financial market and bridging the challenges of accessibility, efficiency and providing opportunities.. So, DFT by securing efficient financial trade-offs has become a key instrument for the marginalized section to be a part of formal financial ecosystem [4].*

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Introduction

The global financial landscape has evolved tremendously post the digitalization in form of Digital Financial Transactions (DFTs). It has emerged as a critical enabler of economic activity and Financial Inclusion [FI] [1]. DFTs consist of electronic monetary trade-off , including online banking, payments through mobile, digital wallets, and crypto-currencies [2]. They have the capacity to transcend beyond geographies and thus reduces cost and improve financial trade-off for unbanked and to the last mile of the society [3]. Thus, been a transformative boon for the global financial market and bridging the challenges of accessibility, efficiency and providing opportunities.. So, DFT by securing efficient financial trade-offs has become a key instrument for the marginalized section to be a part of formal financial ecosystem [4].

Globally there are many platforms for DFTs like M-Pesa, bKash in African continent, and India's Unified Payments Interface (UPI) which has become an enabler to the deprived section receiving access to credit, insurance, and savings through digital mode [5]. Further, these technologies promote economic growth by supporting small and medium enterprises (SMEs), users and citizens of the country by reducing transaction costs, and enhancing market connectivity. Thus, its advantage been user-friendly, innovative and cost efficiency has led to the removal of financial limitations in the society. Further with the expansion of DFT using biometrics and artificial intelligence has induce FI and equitability among all the section of the society. Thus, has been a vital product for building trust in the overall governance system [6].

To enhance public trust in DFTs, the role of financial institutions particularly public and private sector banks is both fundamental and irreplaceable. Banks act as the primary interface between formal financial systems and underserved populations, especially in rural and semi-urban India, by facilitating digital onboarding, offering secure platforms, and disseminating financial literacy (FL) [7]. Furthermore, banks are the realms for integrating this technological enabler (DFTs) by integrating various financial services to it. The innovations of DFT like AI driven personalization, authentication using biometrics and real time assessment of credit bank are at the forefront of building user experience and trust [8]. They have the dual responsibility of service delivery and transformation to every strata of the society from small farmers to young entrepreneur to informal sector [9]. So, the anchoring role of strengthening FI and economic development of individuals in the society is the primary responsibility of these institutions (banks). Thus, supporting Sustainable Development Goals (SDGs) and translating national digital strategies for meaningful impact with resilient DFTs systems is the sole function of the banks [10]. So, a continuous commitment towards innovative path, cyber-security and skill development are some essential functions of banks leading to lasting trust in DFTs and strengthening the socio-economic potential of the country.

Among growing nations, India is at the forefront of DFTs which is driven by innovative platforms like UPI and Aadhaar-enabled system (AePS). These innovations has achieved massive scale of FI and equity not only in India but also globally [11]. Some of their programs and policies such as Pradhan Mantri Jan Dhan Yojana (PMJDY), AePS, and Direct Benefit Transfers (DBTs) has brought over 470 million citizens into the formal banking

ecosystem and reducing financial access gaps [3]. Platforms like UPI have redefined cost efficency, real-time monitoring of DFTs. In India over 100 billion UPI transactions are recorded annually [11].

This success of DFTs in India are largely credit to its robust and multi-tier DFT framework. This includes the Reserve Bank of India (RBI), National Payments Corporation of India (NPCI), banking institutions, and third-party Fin Techs providers. The RBI, as the apex regulator, plays a pivotal role in ensuring monetary stability, setting security standards, and overseeing payment system regulation, including real-time monitoring and grievance redressal mechanisms [12]. The NPCI, an umbrella organization under the RBI, is responsible for designing and operating retail payment platforms such as UPI, RuPay, and AePS, thereby promoting low-cost, interoperable DFT solutions [13]. As the banks acts as institutional support which offeres infrastructure, trust and customer grievances for DFTs. Their collaborative strategy with the financial technology providers (Fin Techs) and other payment apps (e.g., Paytm, PhonePe) has enhanced user convivence and trust among the systems [14]. Innovations in the DFTs are accelerated by the third party provider by building credit models, loyalty points and micro-credit models which can be tailored for the underserve segments of the society [15]. Together, these institutions helps in maintaining sustainable ecosystem, where regulatory oversight, platform innovation, and banking integration converge to drive DFT and ensure safe, accessible, and scalable payment systems.

Despite these robust institutional eco-systems and gains in DFTs, India continues to face critical challenges. Digital illiteracy, especially among older and rural populations, hampers adoption rates, even where access is available [16]. Trust concerns persist around data privacy and cybersecurity, which disproportionately impact first-time users [17]. Infrastructural limitations, such as intermittent internet connectivity and device access, further constrain DFT scalability in remote areas [18]. Gendered disparities and urban–rural divides remain significant, particularly in regions lacking sustained awareness programs [19]. Nevertheless, India's DFT model offers a replicable pathway for other developing nations.

Reviewing the preliminary literature highlights that while urban populations have adapted quickly, rural regions still face challenges related to DI, connectivity, trust in digital platforms, and usability. Research shows that technological interventions in rural India require more than infrastructure; they demand behavioral trust, agent networks, and user-centric design [20]. In this context, institutional stakeholders such as banks and bank officials (officials) play a crucial role in promoting and monitoring DFT adoption through awareness campaigns, feedback mechanisms, and digital onboarding support. Their perceptions can reflect systemic strengths and bottlenecks and provide an indirect yet critical lens on grassroots user experience. Further, understanding the regional and institutional disparities which is often overlooked can hinder uniformity in DFTs. Thus, this study focuses specifically on these institutional stakeholders (officials) perception of DFT, especially in rural contexts of two Indian states. The aims of the study is to fill that gap by offering empirical insights into the socio-technical and policy-level dimensions shaping rural DFT experiences in India. Thus, this study critically examines the factors influencing DFTs behavior in rural India, focusing on Gujarat and

Rajasthan as both are socio-economically diverse yet policy-intensive states in the DFTs landscape. The research is grounded in two hypotheses:

$H1_0$: There is no association between trust in technology, trust in third-party agents, security from fraud, and ease of use on the ratings of DFT.

$H2_0$: There is no statistically significant difference between Gujarat and Rajasthan in any of the officials' perception for compliance, FI, banks' proactiveness, feedback, and government schemes.

Literature Review

The current literature review synthesizes global and Indian experiences, offering a structured inquiry into five key dimensions: the role of DFTs in global financial markets, the trajectory and success story of India's DFT revolution, challenges in DFT implementation across socio-economic and regional contexts, the regulatory and institutional frameworks governing DFTs in India, and the critical role of banks and their officials in mainstreaming DFT adoption.

By examining each of these themes, the paper contributes to a holistic understanding of DFTs from the view point of transformative shift in policy and governance mechanism. The literature review focuses on institutional coordination, regulatory readiness, public trust, and last-mile service delivery. Such multi-layer understanding offers greater insights for academicians, policy researchers and makers, and finally the implementers for strengthen further the DFTs ecosystems in growing economies like India.

Applications of DFTs in International Financial Markets

The DFTs have greatly transformed the world financial markets with enhanced accessibility, efficiency, economic empowerment and inclusion. In emerging economies, the DFTs are a revolutionary tool for attracting the unbanked and underbanked individuals into the mainstream formal financial systems. Globally, the DFT platforms such as M-Pesa in Kenya, Bangladesh-based bKash and India's UPI have provided access to fundamental financial services via the mobile technology with an aim to remove the infrastructural and geographic bottlenecks [21; 22; 23]. Thus, the DFTs not only enhance financial inclusion and accessibility but also economic empowerment by providing easier transactions and greater market access to the SMEs [24]. Fin-Tech platforms drive innovation, business process simplicity, and entrepreneurship, thus contributing to the national GDP [25]. The DFTs create new economic opportunities for the unbanked population and help them integrate into the formal financial ecosystems and decentralized business trends [26]. Also, the DFTs enhance transparency, reduce the cost of transaction, and improves efficiency, resulting in increased productivity within the financial ecosystems [27]. These allow the possibility of settling in real time and minimizing redundancy and thus helps in the optimal utilization of resources [28]. Despite the expanding DFTs that are faced with shortcomings including the missing DI, security threats, infrastructural shortcomings, and a persistent gender digital divide [23;29;30;31]. The future of

the DFTs is dependent on ICT innovations and inclusive digital policies. A complete approach including literacy, confidence creation, and sound regulatory frameworks is critical in ensuring the full potential for equal financial growth for the DFTs. Social inclusion policies, infrastructure investments, and public-private partnerships are critical in ensuring their success [32;33].

India's Success Story of DFTs

The ecosystem of DFTs ecosystem in India started since past decade and has gone through dramatic transformation. The DFTs ecosystem is one of the transformative system globally and has been a reconized model. It has demonstrated integration of public policy with DFTs and has been instrumental in achieving a large scale FI in the country. Since past decade, India's journey DFTs ecosystem has undergone a dramatic transformation.

The implementation of the JAM (Jan Dhan Yojana, Aadhaar, and Mobile) trinity has played a foundational role in enabling millions of Indians to access banking services, thereby narrowing the financial divide [2]. Further, launch of the PMJDY in 2014 laid the foundation for FI by facilitating the opening of over 500 million zero-balance bank accounts, particularly targeting the underserved population [28]. This initiative was complemented by the Aadhaar biometric identification system and the Digital India campaign, creating a digital infrastructure capable of supporting large-scale DFTs [34].

The UPI was launched in 2016 and is it is noted as revolution in DFT ecosystem. It enables interoperable, peer-to-peer transactions in real time, and has seen exponential growth with monthly transactions exceeding 11 billion in the year 2024 alone [35]. Researchers have attributed UPI simplicity, low expense, and government backing as major factors contributing to its success [36]. Research also notes how the DFTs have strengthened the small vendors, farmers, and self-help groups by providing access to formal credit and allowing the business-to-customer dealings [37]. UPI has also been able to achieve this successfully with over 9.3 billion monthly transactions by the year 2023 and adding a contribution of 0.36% to India's GDP [38].

In India demonetization was done in 2016 which has acted as a point for DFT adoption. It has pushed both urban and rural populations toward DFTs [39]. Programmes such as DBT, AePS, mobile wallets has expanded the scope of the DFTs. This has reduced larger leakages in welfare schemes and thus promoting transparency [3;40]. Further , the DFT adoption has increased post COVID pandemic and it showcased India's readiness towards DFT infrastructure. This has been reflected in the RBI's data related to Digital Payments Index [2]. Thus, India's composite digital FI Index has also shown upward trends in both access and use. So, these evidences has underscored DFT role as a driver of equitable economic growth [41].

Challenges of DFT in India

Despite of the overwhelming success of DFT in India as shown in the above literature, challenges still persist particularly in rural parts of the country where DI and infrastructure

deficits hinder the FI. The major challenges includes poor digital infrastructure limitations, vulnerabilities in cyber-securities, and low level trust among vulnerable sections of the country. Literature related to UPI adoption in rural areas has largely highlighted lower awareness and issues with internet connectivity which leads to exclusion from the DFTs [18].

First and foremost concern of DFTs in rural and semi-urban areas is lack of digital skills to navigate digital platforms effectively [29]. It is to be noted that these are the areas where higher concentration of population is seen in the country. Secondly, lower infrastructure which include lower internet connectivity and low penetration of smartphone which constrains the reach of DFTs [34]. Thirdly challenge is the issue of cybersecurity in DFTs adoption which has lead to reduction in trust among the DFT users. Fourthly challenge is institutional issues such as inconsistent regulation of grievance redressal mechanisms and the lack of interoperability across digital platforms are other systemic challenges [37]. Furthermore, gender disparities related to access of mobile phones and knowledge related to DFT create gendered digital exclusion, limiting women's participation in the financial system [27]. Many literature has shown that users' are also concerns over data privacy and unauthorized transactions significantly deter their engagement [30]. Additionally, language barriers and non-intuitive user interfaces contribute to usability challenges for first-time users, particularly in linguistically diverse states [36]. Thus, addressing such challenges requires integrated policy measures that prioritize digital infrastructure, user education, cybersecurity, and inclusive design for DFT.

Regulatory Framework of DFT and its key stakeholders in India

There is has been improvement in the regulatory ecosystem related to DFT in India time and again. The first reform of DFT regulation was the Information Technology Act (2000) ensures legal recognition of electronic commerce and cybersecurity. Secondary, the Prevention of Money Laundering Act (2002) has strengthen financial systems by tracing illicit funds and improving institutional accountability. The Payment and Settlement Systems Act in 2007, has formalized the role of RBI and NPCI in managing electronic payments infrastructure. The Aadhaar Act which was introduce in 2016 brought in biometric identity verification, streamlining subsidy delivery and curbing fraud. Collectively, these acts has improve the DFT ecosystem by fostering security, transparency, and FI, especially for vulnerable section of th country including rural users [42].

Further, India's DFT ecosystem is managed by a robust multi-layered regulatory and institutional framework. Because it has ensure trust, efficiency, and inclusion among the users. This framework involves institutions like the RBI, National Payments Corporation of India (NPCI), Ministry of Finance, banks (public, private and cooperatives) and FinTech firms [43]. At the core is the RBI, which provides regulatory oversight, policy directions, and consumer protection mechanisms for DFTs [44]. Complementing this is NPCI, the architect behind transformative platforms like UPI and AePS, enabling interoperability and secure transactions across financial institution[18]. Banks and Fin-Tech firms are the core implementation agency. Banks act as operational enablers, offering trust infrastructure and service delivery, while Fin-

Tech firms and other payment providers enhance user accessibility and innovation among the DFT ecosystem [44].

Role of Banks and their Official in Strengthening DFT

In the Indian DFT ecosystem, banks play a foundational role in driving the adoption and stability of the systems. They act as both enablers and gatekeeper and thus provide infrastructure, service access, technological interfaces and increase trust. These factors are essential for the functioning of DFT platforms. DFT has transformed the Indian banking sector, particularly through digital platforms and mobile applications, has empowered users to conduct secure and efficient transactions even in remote locations [45]. Further, public sector banks, in particular, have extended Aadhaar-enabled services and UPI-based payments, allowing marginalized populations to enter formal financial systems. Also, officials at various banking levels serve as intermediaries between DFT systems and users, particularly in rural areas. As a "principal–agent" relationship, where trust in bank representatives significantly influences user participation in DFTs [46]. Further, it highlighted that supply-side issues like inadequate infrastructure and low commissions for banking agents undermine this trust, ultimately impeding DFT adoption. Digital officers are not only facilitators but also educators. They help bridge the gap for those with limited DI by guiding customers through onboarding, grievance resolution, and safety practices. This institutional mediation is particularly critical for first-time users or digitally excluded groups [10]. Moreover, banks' collaboration with third-party fin-tech providers has accelerated innovation and increased user trust by introducing more intuitive platforms, as noted in the CBDC study by [47]. Thus, bank officials are pivotal in ensuring last-mile delivery of DFT services. Their presence, training, and incentives play a critical role in shaping the public's perception of security, ease of use, and trust in digital platforms—components essential for the success of DFTs in India.

Thus, the existing literature has shown that DFT has been potential in promoting FI, efficiency, and economic resilience. India's success demonstrates how targeted policy frameworks, institutional innovation, and technological integration can accelerate DFT adoption. However, challenges like infrastructural gaps, DI deficits, cybersecurity concerns, and socio-regional disparities hinder universalization. Financial institutions, particularly banks and their officials, play a crucial intermediary role in translating DFT policies into on-ground adoption through user trust-building, interface support, and outreach.

Methodology

This study adopted a qualitative research design, using a structured questionnaire as the primary instrument for data collection. The questionnaire consisted of 50 items, systematically organized into thematic sections to explore various aspects of DFTs in rural banking environments. The first ten questions collected demographic data, while questions 11 to 15 gathered information about the respondents' job roles and their associated banking institutions. Questions 16 to 19 focused on customer training, management of loan accounts, and compliance practices. Perceptions related to trust, ease of use, and security were assessed in questions 21 to 24. Questions 25 to 31 investigated participants' basic engagement with

DPTs, whereas questions 32 to 44 explored user perceptions in greater depth. Questions 45 and 49 addressed the challenges encountered and proposed solutions to enhance DPT usage, while questions 46, 47, and 49 examined infrastructural aspects such as business correspondents, government schemes, and customer support mechanisms. The final question, number 50, asked participants to rate their overall satisfaction with DPTs.

A pilot study was conducted in the Valsad district of Gujarat from June 18 to June 25, 2024, involving five villages. Based on pilot feedback, modifications were made to questions 24, 34, 38, and 50. Subsequently, the final phase of data collection was implemented across both Gujarat and Rajasthan to ensure a broader and more diverse sample. The study ultimately collected 182 responses from individuals associated with public and private sector banks, cooperative banks, and payment banks in rural areas. During the duration of study there were various challenges faced by the team one major hurdle was obtaining approval from bank managers to interact with the officials. The primary reason was concerns regarding data privacy and the potential misuse of collected information.

Another challenge which was later mitigated was occurred during the pilot phase of the study were handling of hard-copies of questionnaires had created logistical issues and raised environmental concerns. To mitigate it, the questionnaire was digitized and deployed via Google Forms, facilitating efficient and real-time online data collection. Also, the data collection tool was tailored to local language in Gujarati for Gujarat and Hindi for Rajasthan. Minampati et al., (2025) suggest that Google Forms offers several benefits in action research such as eco-friendliness, streamlined data entry, and improved data reliability [48]. The feature of Google form regarding real-time data capturing enabled researchers to focus more on analytical tasks rather than manual data processing which enhancs the overall effectiveness of the research.

Table 1: Demographic Categorization of Officials in Gujarat and Rajasthan.

Demography	**Sub Category**	**Count**	**Demography (in %)**	**Gujarat**	**Gujarat (in %)**	**Rajasthan**	**Rajasthan (in %)**
Gender	Male	144	79.12	63	77.78	81	80.2
Gender	Female	38	20.88	18	22.22	20	19.8
Marital Status	Married	117	64.29	46	56.79	71	70.3
Marital Status	Single	60	32.97	32	39.51	28	27.72
Marital Status	Widow	4	2.2	2	2.47	2	1.98
Marital Status	Div/Separated*	1	0.55	1	1.23		
Employment Type	Public	91	50.00	32	39.51	59	58.42
Employment Type	Private	77	42.31	43	53.09	34	33.66
Employment Type	Others	14	7.69	6	7.41	8	7.92

*Divorced/Separated

Source: Compiled by Authors

Table 1 indicates the demographic profile of the officials who participated in the study. The data suggest a marginal dominance of participants from Rajasthan state at 55.49% compared to Gujarat which had 44.51% officials. This highlights that there was unbalanced regional representation among the both state in the study. The distribution of gender was significant skew as male respondents accounts for 79.12% of the total sample, while female participation was only 20.88%. This gender disparities was consistent across both states, reflecting the broader patterns of gender involvement in DFT ecosystem in rural India.

Further in terms of employment type, public sector employees constituted to be the largest group with 50.00% respondents. This was followed by private sector officials and then the other banks which largely includes cooperative banks. Thus, there was strong presence of government-affiliated workers among the respondents. This may have influence their perception due to their engagement with formal DFT ecosystem. This dominance also point out higher levels of FI and structured access to banking infrastructure in DFT ecosystem

Results

The study implies the quantitative research design to evaluate the above mentioned hypothesis related to DFT. Following section of the study uses three different methods of analysis namely cross sectional analysis (CSA), ordinal logistic regression (OLR) and principal component analysis (PCA) to examine the hypotheses. The following section of discussion provides the interpretation to these findings and how these findings has been positively and negatively associated with earlier studies findings.

Cross Sectional Analysis

CSA is considered to the most simplest form of analysis and is one of the prominent form for understanding the DFTs adoption in rural India. The CSA approach offers how the DFT designing can be inclusive and tailored to rural contexts. This includes enhancing both accessibility and impact of DFT in rural areas. Additionally, it supports national goals like the Digital India initiative by providing evidence based policies, thus, fostering equitable of DFTs engagement among the country [49].

In the current study, CSA has been implied as it is deemed to be the most appropriate analytical approach . In the data collection tool there are seven questions that are nominal in nature and non-continuous which makes them eligible for the CSA. These questions were designed to offer descriptive insights aligned with the study's objectives. Specifically, these questions highlighted key dimensions such as patterns of adoption and compliance of DFTs, communication & outreach strategies employed by banks, consumer perception & transaction typologies, operational challenges encountered during service delivery, and user feedback & preferences. Thus, the use of CSA enabled a systematic interpretation of categorical data, and facilitated understanding of trends and user experiences within the rural DFT ecosystem. Below are the results of four direct questions related to DFT.

Table 2 compares modes of loan repayment across bank types in Gujarat and Rajasthan. Overall, 64.3% of respondents reported paying by cash, while 35.7% used bank transfers. Gujarat had a higher proportion of DFT repayments (40.7%) than Rajasthan (31.7%). Private banks in Gujarat showed higher reliance on bank transfers (20.9%) compared to Rajasthan (13.9%), while public banks in Rajasthan had greater cash usage (41.6%) than Gujarat (22.2%). These trends suggest regional and institutional variation in DFTs adoption, with Gujarat exhibiting slightly more DFT behaviour.

Table 2: Details on how does Loan Account Holders pay their loans in Rural India

Details	Type of Bank	Guj	Guj (%)	Raj	Raj (%)	Total	Total (%)
Bank transfers		33	40.74	32	31.68	65	35.71
	Others	2	2.47	1	0.99	3	1.65
	Private	17	20.99	14	13.86	31	17.03
	Public	14	17.28	17	16.83	31	17.03
Cash		48	59.26	69	68.32	117	64.29
	Others	4	4.94	7	6.93	11	6.04
	Private	26	32.10	20	19.80	46	25.27
	Public	18	22.22	42	41.58	60	32.97
Grand Total		81	100.00	101	100.00	182	100.00

Source: Compiled by Authors

Table 3 presents modes of communication and outreach for promoting DFT across banks in Gujarat and Rajasthan. Bank officials remain the most utilized channel in both states (29.7%), followed by SMS (27.5%), especially prominent in Rajasthan (36.6%). Email usage ranks third (19.2%), with greater adoption in Gujarat. Public sector banks are more active in outreach, particularly via SMS and direct communication. Mass media and external agents play a limited role, while "others" remain marginal.

Table 3: Details of Mode of Communication and Customer Outreach through Banks in Rural India for DFT.

Modes of Communication & Customer Outreach	Types of Bank	Guj (in no)	Guj (%)	Raj (in no)	Raj (%)	Total (in no)	Total (%)
Via Bank Officials		25	30.86	29	28.71	54	29.67
	Others	2	2.47	2	1.98	4	2.20
	Private	14	17.28	7	6.93	21	11.54
	Public	9	11.11	20	19.80	29	15.93
E-mails		18	22.22	17	16.83	35	19.23
	Others	2	2.47	1	0.99	3	1.65
	Private	11	13.58	8	7.92	19	10.44

	Public	5	6.17	8	7.92	13	7.14
External agents		10	12.35	7	6.93	17	9.34
	Others	2	2.47	1	0.99	3	1.65
	Private	4	4.94	4	3.96	8	4.40
	Public	4	4.94	2	1.98	6	3.30
Mass media (TV, radio, newspapers, etc.)		9	11.11	8	7.92	17	9.34
	Others		0.00	1	0.99	1	0.55
	Private	5	6.17	2	1.98	7	3.85
	Public	4	4.94	5	4.95	9	4.95
Others		6	7.41	3	2.97	9	4.95
	Others		0.00	1	0.99	1	0.55
	Private	4	4.94	2	1.98	6	3.30
	Public	2	2.47		0.00	2	1.10
SMS		13	16.05	37	36.63	50	27.47
	Others		0.00	2	1.98	2	1.10
	Private	5	6.17	11	10.89	16	8.79
	Public	8	9.88	24	23.76	32	17.58
Grand Total		81	100.00	101	100	182	100.00

Source: Compiled by Authors

The table 4 highlights the types of complaints received by banks regarding DFT in Gujarat and Rajasthan. Fraud-related complaints were the most common overall (36.3%), with comparable proportions in both states. Technical issues ranked second (33.5%), with Gujarat reporting slightly higher incidence (38.3%) than Rajasthan (29.7%). Delay in receipt was notably higher in Rajasthan (34.7%) than Gujarat (23.5%). Public sector banks reported more complaints overall, especially in fraud and delay categories, while private banks faced more technical issues in Gujarat.

Table 4: Types of Complaints by Banks Regarding DFT in Rural India

Types of Complaints	Types of Banks	Guj (in no)	Guj (in %)	Raj (in no)	Raj (in %)	Total (in no)	Total (in %)
Delay in receipt		19	23.46	35	34.65	54	29.67
	Others	4	4.94	2	1.98	6	3.30
	Private	7	8.64	12	11.88	19	10.44
	Public	8	9.88	21	20.79	29	15.93
Fraud		30	37.04	36	35.64	66	36.26

	Others	2	2.47	1	0.99	3	1.65
	Private	16	19.75	13	12.87	29	15.93
	Public	12	14.81	22	21.78	34	18.68
Others		1	1.23		0.00	1	0.55
	Private	1	1.23		0.00	1	0.55
Technical issues		31	38.27	30	29.70	61	33.52
	Others		0.00	5	4.95	5	2.75
	Private	19	23.46	9	8.91	28	15.38
	Public	12	14.81	16	15.84	28	15.38
Grand Total		81	100.00	101	100.00	182	100.00

Source: Compiled by Authors

The table 5 highlights the preferred DFT modes across selected states Gujarat and Rajasthan. UPI emerged as the most preferred mode (25.8%), especially in Gujarat (30.9%). NEFT/IMPS (21.4%) and Online Banking (23.1%) followed, with near-equal preference across states. AePS usage was significantly higher in Rajasthan (20.8%) compared to Gujarat (11.1%), likely due to rural outreach. Third-party payments showed moderate preference, notably higher in Rajasthan. Public sector banks dominated AePS and third-party payment usage, while private banks led in UPI and NEFT adoption. The findings reflect varied DFTs preferences by region and bank type, highlighting the importance of tailored DFTs strategies.

Table 5: Most Preferred DFT by Customers in Rural India

Most Preferred DFT	Types of Banks	Guj (in no)	Guj (in %)	Raj (in no)	Raj (in %)	Total (in no)	Total (in %)
AePS		9	11.11	21	20.79	30	16.48
	Others	1	1.235	1	0.99	2	1.10
	Private	2	2.469	7	6.931	9	4.95
	Public	6	7.407	13	12.87	19	10.44
NEFT/IMPS		22	27.16	17	16.83	39	21.43
	Private	13	16.05	8	7.921	21	11.54
	Public	9	11.11	9	8.911	18	9.89
Online banking		19	23.46	23	22.77	42	23.08
	Others	2	2.469	3	2.97	5	2.75
	Private	11	13.58	6	5.941	17	9.34
	Public	6	7.407	14	13.86	20	10.99
Third party payments		6	7.407	18	17.82	24	13.19
	Others	1	1.235	1	0.99	2	1.10

	Private	1	1.235	5	4.95	6	3.30
	Public	4	4.938	12	11.88	16	8.79
UPI		25	30.86	22	21.78	47	25.82
	Others	2	2.469	3	2.97	5	2.75
	Private	16	19.75	8	7.921	24	13.19
	Public	7	8.642	11	10.89	18	9.89
Grand Total		81.00	100.00	101.00	100.00	182.00	100.00

Source: Compiled by Authors

Ordinal Logistic Regression Analysis

$H1_0$ There is no association between trust in technology, trust in third-party agents, security from fraud, and ease of use on the ratings of DFT.

Further, to understand the perception rural customers regarding to DFT through lenses of officials, OLR analysis is done. Moreover, as the data of the study was ordinal in nature and had one outcome variable Q50 (Ratings) in five point Likert scale. The model was developed using four predictable variables namely trust in technology, trust in third party agents like BHIM, UPI etc, security from fraud and ease of use. As, in earlier literature OLR has proven effective in DFTs research for examining satisfaction and trust. Kant (2024) applied it for fraud detection, while Chowdhury and Ghosh (2024) linked ATM use to FI [50;51]. Tribhan (2024) used OLR to study demographic and usability influences [52]. These studies demonstrate OLR's value in capturing user perceptions in DFT contexts.

The results from the study model summary of OLR analysis given in table 6 reveals that among the key predictors, trust in technology showed no statistically significant effect on rating outcomes (Estimate = -0.014, p = 0.943), indicating that officials' perception that the customer are confidence in technological systems alone did not meaningfully impact their evaluations. Trust in agents, such as third-party service providers like PayTM and BHIM, had a positive estimate (Estimate = 0.374, p = 0.067), suggesting a marginally significant association; officials also reported higher trust in these agents were somewhat more likely to provide favourable ratings. Similarly, ease of use demonstrated a marginally significant influence as per the perception of the officials (Estimate = 0.262, p = 0.098), implying that the perceived usability of DFT platforms played a modest role in shaping user evaluations. Conversely, security concerns were not a significant factor (Estimate = -0.007, p = 0.960), suggesting limited impact on users' assessments. Threshold values between rating levels indicated statistically significant distinctions particularly at the 3/4 (0.513) and 4/5 (0.912) cut-off points, underscoring meaningful shifts in perception across higher satisfaction levels.

Table 6: Model Summary of OLR

Statistic	Value
Dep. Variable	Rating
Model	OrderedModel

Method	Maximum Likelihood
No. Observations	182
Df Residuals	174
Df Model	8
Log-Likelihood	-222.64
AIC	461.3
BIC	486.9

Term	coef	std err	z	P>|z|	[0.025	0.975]
Trust Tech	-0.0144	0.203	-0.071	0.943	-0.412	0.383
Trust Agent	0.3735	0.204	1.834	0.067	-0.026	0.773
Security	-0.0072	0.142	-0.05	0.96	-0.286	0.272
Ease	0.2618	0.158	1.656	0.098	-0.048	0.572
Threshold Levels						
1/2	-1.6251	1.253	-1.297	0.195	-4.081	0.831
2/3	0.43	0.292	1.47	0.141	-0.143	1.003
3/4	0.5133	0.142	3.625	0	0.236	0.791
4/5	0.9116	0.092	9.889	0	0.731	1.092

Source: Compiled by Authors

ANOVA Analysis

$H2_0$: There is no statistically significant difference between Gujarat and Rajasthan in any of the officials' perception for compliance, FI, banks proactiveness, feedback and government schemes.

The study to get more insights into the perception of customer from the viewpoint of officials conducted ANOVA analysis. The ANOVA analysis was conducted for the Q32 to Q43 for the dependent variable been Q50 (Ratings). As ANOVA is designed to evaluate the effect of one independent factor on a single dependent variable, it is particularly effective for determining statistically significant differences across multiple groups based on that variable [53]. In this study, the dependent variable been the rating and significance of difference explained by the selected states.

The results from the one-way ANOVA analysis, summarized in Table 7, revealed that none of the nine measured perception items showed statistically significant differences between Gujarat and Rajasthan (all p-values > 0.05). While some minor perceptual variations were present, they did not reach the level of statistical significance required for meaningful differentiation between the two states. Among the tested dimensions, the item related to compliance with DFT norms (Q32) reported the highest between-group variance ($F = 2.57$, $p = 0.111$), but this did not reach statistical significance. Similarly, officials' views on customer

awareness efforts by banks (Q33) and proactiveness in technological upgradation (Q34) had near-significance values (F = 2.07, p = 0.152 and F = 2.23, p = 0.137, respectively), indicating modest perceptual variation, though not strong enough to draw inferential conclusions. Thus, the results suggests that officials across both states generally perceived customer engagement with DFT in a consistent manner, without meaningful regional variation.

Table 7: One-Way ANOVA Summary: Comparative Analysis of Officials' Perceptions on DFT Between Gujarat and Rajasthan

Sr No	Question No	Variables	Question Text	F-statistic	p-value
1	Q32	Compliance	Do you think digitalisation has improved the payment systems?	2.567	0.111
2	Q33	Proactiveness of Financial Institution	Do you think your bank is working towards improving the security of DFT?	2.066	0.152
3	Q34	Proactiveness of Financial Institution	Do you think your bank is improving the technological experience of DFT?	2.226	0.137
4	Q35	Feedback from Customer	Does your bank invite customer suggestions about improving DFT?	0.261	0.610
5	Q36	Feedback from Customer	Has your bank ever conducted a survey about customer experience on DFT?	0.001	0.972
6	Q40	Significance of DFT	Do you think manpower requirement is reduced due to digitalization of payments?	1.702	0.194
7	Q41	Financial Inclusion	Do you think DFT have led to improvement of FI in rural areas?	0.213	0.645
8	Q42	Financial Inclusion	Do you think digitalization of payments have led to opening up of more bank accounts?	0.119	0.731

9	Q43	Government Scheme	Do you think Jan Dhan accounts have facilitated digitalization of payments in rural areas?	0.119	0.731

Source: Compiled by Authors

Discussion

A growing corpus of scholarly literature has investigated various facets of DFT. However, relatively limited attention has been directed toward examining their implications for policy adaptation. Budiasih (2024) contends that DFT transformation necessitates strategic realignment of policy frameworks to accommodate emerging trends in financial management [54]. Balasubramanian et al. (2024) underscore the instrumental role of DFT in augmenting operational efficiency and advancing FI, particularly among small and marginal vendors [55].

Similarly in recent years, cross-sectional studies have become pivotal in recent years for analysing the behavioural and structural dynamics of DFT in India. Jagtap (2024), using a CSA survey of 400 respondents in Pune, reveals that 85% of users express high satisfaction with Google Pay and PhonePe—driven by interface reliability, ease of use (65%), and speed (60%) [56]. These insights underscore the role of real-time user experience in shaping DFT adoption. Balasubramanian et al. (2024), through secondary CSA, trace the exponential rise in DFT volumes—from $96 billion (2010–11) to $7,195 billion (2021–22)—and highlight shifts from credit transfers to RTGS [55]. Their findings emphasize DFT's transformative impact on small traders and call for expanded DFT infrastructure, particularly in India's underserved rural regions. Furthermore, the CSA from the current study reveals significant regional and institutional disparities in DFTs behaviour across Gujarat and Rajasthan. Cash remains the dominant loan repayment mode (64.3%), with DFTs adoption higher in Gujarat, especially among private bank users. Communication strategies rely heavily on bank officials and SMS, with Rajasthan showing limited channel diversity. Fraud (36.3%) and technical issues are major complaints, particularly in public sector banks. UPI is the most preferred DFT mode overall, while AePS and third-party platforms are more common in Rajasthan, indicating dependency on assisted technologies. These findings highlight the need for targeted digital inclusion strategies. Public banks should expand digital repayment incentives and adopt diversified outreach methods, including local language tools and SHG-led campaigns. Strengthening cybersecurity infrastructure, deploying responsive grievance redressal systems, and enhancing DI especially for rural and older populations are essential. Expanding AePS and onboarding rural users to UPI through simplified interfaces can further drive inclusive and secure DFT adoption. Thus, DFT policies must therefore shift from one-size-fits-all models to localized, context-specific digital inclusion strategies, with a focus on user-centric design, grievance redressal, cybersecurity, and inclusive outreach. Bridging these digital gaps will be instrumental in achieving equitable FI across India's diverse rural landscape.

OLR has emerged as a robust analytical method for assessing financial behaviour in the context of DFT. Zaimovic et al. (2024) employed OLR alongside PROCESS mediation analysis using cross-sectional adult literacy survey data from Bosnia and Herzegovina,

highlighting a significant relationship between DFT and digital financial behaviour (DFB [57]. Their findings indicate that while most socio-economic variables significantly predict DFB, gender does not exhibit a statistically significant effect. In a similar vein, Peter et al. (2024) conducted an OLR-based analysis of a primary survey comprising 223 women entrepreneurs in India, focusing on DFT usage for loan applications and asset management [58]. The study demonstrates that DFTs literacy and financial skills are significant determinants of improved financial decision-making among women entrepreneurs. Collectively, these studies affirm the appropriateness of OLR for analysing rural financial perceptions, particularly through the lens of institutional stakeholders and user behaviour in developing economies. The OLR analysis from the current study examined that two predictors, trust in technology ($p = 0.943$) and security from fraud ($p = 0.960$) had no significant influence on satisfaction ratings, indicating these factors were not decisive in shaping user evaluations. However, trust in third-party agents like BHIM and PayTM ($p = 0.067$) and ease of use ($p = 0.098$) showed marginal significance, suggesting these aspects modestly improved user satisfaction. Threshold values between ratings 3/4 and 4/5 were significant, indicating clearer perception shifts at higher satisfaction levels. Policy suggestions include enhancing trust in verified third-party platforms through agent certification and public endorsement, and prioritizing interface simplification and vernacular access for rural users. Since backend security alone does not drive satisfaction, awareness campaigns should visibly communicate safety measures. Policies must emphasize user-centric design and local trust ecosystems to strengthen DFT engagement in rural India.

One-way ANOVA is largely use in the studies to identify user satisfaction or adoption across different demographic segments. A paper by Sandhya Rani et al. (2024), uses this statistical technique and linear regression model on 100 users of DFT for applications like Google Pay and Phone Pay [59]. The ANOVA analysis confirmed variations in satisfaction among these platforms and major drivers of this satisfaction are security, ease of use, case back offers, time efficiency and 24/7 grievance availability. Further, variability among users was the notable points in spite of higher trust in DFT platforms. ANOVA results from Dixit (2024) highlights significant difference across age-groups and higher adoption rate among 26-35% of respondent [60]. The gender differences was for the variable digital privacy as women express more concern related to it. Thus, one-way ANOVA determine there are significant differences between the means of three or more independent groups. From the one way ANOVA revealed no statistically significant differences in officials' perceptions of DFT across Gujarat and Rajasthan (all p-values > 0.05), suggesting a broadly consistent outlook between the two states. Among the nine perception items tested, the highest—but still non-significant—variance was observed in compliance with DFT norms (Q32; $F = 2.57$, $p = 0.111$). Near-significant differences were also noted in officials' perceptions of customer awareness efforts (Q33; $F = 2.07$, $p = 0.152$) and technological upgradation by banks (Q34; $F = 2.23$, $p = 0.137$). These trends imply minor perceptual differences without sufficient evidence for regional divergence. Policy suggestions related to DFT from one way ANOVA include strengthening state-specific monitoring frameworks for DFT compliance and standardizing customer awareness campaigns to ensure uniform reach. Investment in technology infrastructure upgrades, particularly in lagging districts, may help align perceived institutional performance. Overall, coordinated inter-state DFTs strategies should be developed to reinforce consistent, inclusive, and proactive DFTs engagement across regions.

Limitation

As, this study provide academic insights into the DFT in rural area but there are several limitation which should be acknowledged. First, the analysis captures user perceptions exclusively through the lens of institutional stakeholders (officials), potentially overlooking the nuanced experiences and behavioural drivers of end users themselves. Second, the study is geographically limited to Gujarat and Rajasthan, which, while diverse, may not reflect broader national patterns or policy impacts across other socio-cultural regions. Methodologically, the CSA design restricts the ability to draw causal inferences and is subject to snapshot bias and potential self-reporting errors. The use of OLR, while effective for modelling ordinal outcomes, does not account for unobserved heterogeneity—such as users' self-confidence in digital tools or peer influences—that could significantly shape digital engagement. Additionally, the one-way ANOVA analysis is limited by its focus on a single dependent variable and binary state comparison, which may oversimplify complex regional dynamics and institutional perceptions.

Conclusion

This study offers a comprehensive analysis of the institutional perception of DFTs in rural India, with a specific focus on two socio-economically diverse states of Gujarat and Rajasthan. The findings demonstrate that while DFTs have emerged as a transformative tool for FI, their adoption and acceptance in rural contexts remain shaped by a constellation of factors including institutional outreach, trust in intermediaries, perceived usability, and infrastructural readiness. CSA highlights a continuing reliance on cash-based transactions, although Gujarat exhibits relatively higher DFT adoption. Communication strategies are dominated by direct interactions with bank officials and SMS, with limited use of mass media or external agents, reflecting constraints in outreach diversification. Fraud and technical issues emerged as major barriers to trust, particularly in public sector institutions. OLR analysis revealed that while trust in technology and security from fraud were not statistically significant in influencing user satisfaction, trust in third-party agents and ease of use exhibited marginal significance, indicating that ease of use interface design and agent networks may play a more pivotal role in driving DFT engagement. The one-way ANOVA results confirmed the absence of statistically significant regional differences across key institutional perceptions, suggesting a broadly consistent institutional outlook between the two states. The study underscores the importance of a localized, user-centric, and trust-based approach to DFT policy implementation. Policy efforts should focus on simplifying DFT interfaces, promoting vernacular accessibility, certifying third-party agents, and enhancing visible cybersecurity communication. Additionally, uniform customer awareness campaigns and inter-state cooperation could bridge minor perceptual gaps and promote a more cohesive national DFT strategy. While the study's scope is limited by geography and its institutional lens, it nonetheless offers valuable empirical insights into the socio-technical and policy dimensions of rural DFT adoption in India, contributing to the discourse on inclusive DFT in developing economies.

Future studies should directly assess user perceptions to complement institutional insights. Research can adopt a multi-stakeholder lens, incorporating perspectives from end-

users, agents, and fin-tech providers. Employing longitudinal or panel data will enable tracking of behavioural changes over time. Additionally, interaction-based and multilevel modeling approaches can better capture the complex socio-technical dynamics and regional variations that shape DFT usage in India's diverse rural contexts, thereby offering more granular and policy-relevant insights for inclusive digital financial ecosystems.

Author Contributions

1. Dr Venkat Ram Reddy Minampati – Concept Development and Data Collection
2. Dr Sriram Divi – Paper Development
3. Dr Harmik Vaishnav –Data Cleaning and Analysis

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Data Availability

Authors should state where data supporting the results reported in a published article can be found, and under what conditions the data can be accessed. They also include links (where applicable) to the data set.

Conflict of Interest

The authors declare that they have no conflict of interest.

Abbreviations

DFTs - Digital Financial Transactions
UPI - Unified Payments Interface
SMEs - Small and Medium enterprises
AI - Artificial Intelligence
AePS - Aadhaar-enabled Payment Systems
PMJDY - Pradhan Mantri Jan Dhan Yojana
DBTs - Direct Benefit Transfers
RBI - Reserve Bank of India
NPCI - National Payments Corporation of India
Fin Techs - Financial Technology Providers
Officials - Banks and Bank Officials
JAM- Jan Dhan Yojana, Aadhaar, and Mobile
FI - Financial Inclusion
DL - Digital Literacy
FL - Financial Literacy

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