LEX LOCALIS-JOURNAL OF LOCAL SELF-GOVERNMENT
ISSN:1581-5374 E-ISSN:1855-363X
VOL. 23, NO. S5(2025)

"THE ROLE OF FINTECH AND TECHNOLOGY IN DELIVERING AFFORDABLE HOUSING FINANCE IN BANKING SECTOR AT ANDHRA PRADESH"

Mrs. Thammisetty Srilakshmi[1], Dr. Gangadhara Rao U[2], Dr. Manchala Veera Krishna[3], Dr. Peddada Satya Bala Ram[4]

[1]Assistant Professor, Department of MBA, QIS College of Engineering and Technology, Ongole, Prakasam District, Andhra Pradesh, India. ORCID: 0009-0005-8841-3786.
[2]Assistant Professor, Department of Management, Rajiv Gandhi University of Knowledge Technologies, Nuzvid, Eluru District, Andhra Pradesh, India. ORCID: 0009-0005-8609-8399.
[3]Assistant professor, Aditya University, Andhra Pradesh, India,
[4]Associate Professor, V. S. Lakshmi Institute of Management Studies for Women, Kakinada, India

thammisettysrilakshmi@gmail.com[1]
mba.ugr@rguktn.ac.in[2]
veerakrishnam@adityauniversity.in[3]
balaramfinance007@gmail.com[4]

ABSTRACT
Easy availability of affordable housing finance continues to be a major obstacle for low- and middle-income groups in India (especially in Semi-Urban & Rural areas). In recent times, financial technology (fintech) has become a game changing instrument, capable of ensuring the banking service at the fingertip in a better way, cheaper and faster. This paper tries to analyse the potential of fintech and digital technology for affordable housing financing in the banking sector in Andhra Pradesh under the PM Awas Yojana. A quantitative research design was used and a sample of 450 housing loan beneficiaries and 50 banking professionals from five districts were selected for the data collection. The analysis uses multiple linear regression and moderated regression to estimate the links between prospective fintech utilization, housing finance performance and institutional barriers.

It shows that fintech implementation in terms of tools like mobile-based loan apps, Aadhaar based e-KYC, online EMI calculators and automated status trackers have significant positive impact on the accessibility, loan processing and borrower satisfaction. Fintech solutions offering price transparency and subsidy integration have a positive impact on perceptions of affordability. But here the effectiveness of these technologies is mediated by institutional and contextual obstacles — low digital literacy, staff opposition, weak and fractured internet connectivity, and so on. The conditioned model regression analysis supports that these barriers moderate the positive relationship between fintech and beneficiary satisfaction.

The research found that though fintech offers significant potential in relation to democratizing access to low-cost housing finance, it is contingent on an enabling environment that factors digital infrastructure, skilled human resources and borrower empowerment. The manuscript provides practical policy and managerial guidance to scale up fintech solutions inclusively and sustainably in housing finance. It adds to the literature by situating fintech adoption within state-level landscapes and empirical evidence on what it can and cannot accomplish in the realm of affordable housing finance.

Keywords: Fintech Adoption, Affordable Housing Finance, Digital Banking, Institutional Barriers, Financial Inclusion

1. Introduction

Housing for All has been identified as a key developmental challenge in India, with a special focus on the poor belonging to the economically weaker sections (EWS) and lower income groups (LIG) for whom access to formal credit for purchasing a house remains a perennial problem. The problem is particularly severe in states like Andhra Pradesh where rapid urbanisation, increasing land costs and low penetration of financial institutions in rural and semi-urban regions have resulted in very large housing shortages. Conventional banking environment has faced significant challenge of providing inclusive, readily available and

efficient credit to unbanked masses due to high transaction costs, inflexible documentation processes and limited reach of poor in rural areas (Kumar & Singh, 2023). In this vein, the rise of financial technologies (fintech) and digital banking innovations provide a transformative opportunity to reduce the transaction costs resulting from unmet supply of housing finance needs.

Fintech innovations – for example mobile banking apps, digital KYC (know your customer) AI-based credit scoring, digital loan underwriting and blockchain-based documentation – are transforming the delivery of affordable housing finance. These innovations promise to lower costs, lower credit rationing, shorten turnaround times, and improve the estimate of risk, especially for low-income and new borrowers (Bansal et al., 2022). Additionally, technology-based platforms are enabling banks to widen their reach as well as to customise loan products with API's, data-based algorithms and smooth loan disbursal functionalities (Verma & Bhatnagar, 2023). Despite this potential promise, the take-up and effect of fintech tools for state-level application, such as Andhra Pradesh have not been fully explored, especially in relation to whether they play a role in the teething promised affordable housing finance by formal banks.

This paper aims at understanding the potential of digital technology and fintech in scaling the delivery of affordable housing finance by the banking industry in the state of Andhra Pradesh. This part seeks to understand the depth of fintech inclusion, how much of a game changer it has been in terms of making finance affordable and accessible and the constraints financial institutions face in adopting such technologies. The study adopts a bigger picture to uncover evidence-based learnings that have the potential for policy interventions to enhance policy frameworks, financial inclusion and mainstreaming of the fintech innovations in line with affordable housing aspirations under the national missions such as Pradhan Mantri Awas Yojana (Urban and Rural). By adopting a regionally embedded and policy-relevant enquiry, this paper makes a unique contribution to the emerging fintech literature, with potential practical implications, not only for bank practitioners, fintech start-ups and their respective stakeholders, but also those in the housing policy domain as well.

2. Background of the Study

The importance of housing as a basic human need and a precursor to social and economic development is well known. But housing finance is still inaccessible to large part of the population in India, especially to the EWS/LIGs. According to government statistics, the urban housing shortage in India is over 10 million units, being highly concentrated in rural and semi-urban areas of states like Andhra Pradesh (Ministry of Housing and Urban Affairs, 2022). Notwithstanding various national level interventions like Pradhan Mantri Awas Yojana (PMAY), the accessibility and efficiency of housing finance delivery through the traditional banking sector has been far from satisfactory as it encounters various bottlenecks like long process of loan approval, limited physical reach, risk averse lending, low digital penetration in rural market (Raj & Kulkarni, 2023).

Over the last frames, fintech has become a critical driver in addressing these financial access gaps, and particularly so in under-serviced areas. Innovations in digital lending platforms, biometric KYC, mobile loan applications, and AI credit scoring models have reshaped the traditional operational models of banks. These have brought down the cost of transactions, made the loan approval process more efficient, and improved the evaluation of credit risks, making housing finance more affordable and inclusive (Sharma & Bhatt, 2023). "Public and

private banks in India are collaborating with fintech companies to automate house loan approval processes, introduce digital pre-approval of support and use data analytics to customise products for rural customers. This is in line with the Government of India's initiative of Digital India and emphasis on financial and technology inclusion for public welfare (Mehta and Joshi, 2022).

The state of Andhra Pradesh has made encouraging progress in propelling digital inclusion, particularly through rural broadband initiatives, Aadhaar e-KYC and banking correspondents. However, there is a dearth of empirical research regarding the extent to which fintech and technology are affecting the provision of affordable housing finance in this regard. Little is known about how banks utilise these tools at the local level or of the success of specific interventions in terms of affordability, use and borrower satisfaction. The current state of the art in affordable housing finance in Andhra Pradesh is such that little is known about this, and this study aims to plug this gap by taking a hard look at the fintech landscape in affordable housing finance delivery in the state, focusing both on the opportunities and systemic challenges presented by the system as it exists currently.

3. Role of Fintech and Technological Innovation

The landscape of financial service delivery around the world, especially in emerging markets such as India, has been significantly transformed by the rise of financial technology (fintech). For affordable housing finance, fintech-driven innovation provides a disruptive way to hurdle over entrenched barriers—of high transaction costs, unwieldy processes, lack of documentation, poor financial penetration, etc.—for financing for the poor and those on the excluded fringes. With the use of digital technology, banking and housing finance companies can now provide loans which are more accessible, easier to administer and comply with the customer's requirements of the economically weaker sections (EWS) and low-income groups (LIGs) (Pousttchi et al., 2023).

Fintech innovations like mobile-based lending apps, e-KYC verification with the help of Aadhaar, artificial intelligence(AI) for credit underwriting, machine learning algorithms to assess risk and APIs for real-time seamless integration, have completely transformed housing loan processes in India. These have helped accelerate the loan approval, digital processing, and real-time verification of the borrower, reducing reliance on physical infrastructure. Subsequent to this, banks can better extend their services in such under-served geographical pockets of Andhra Pradesh where traditional banking systems cannot reach in a sufficient manner (Venkatesh & Gupta, 2023). For example, digital housing finance platforms such as the ones that Dubhashi's company runs enable users to compare loan products, check their eligibility for subsidies under schemes such as PMAY, upload documents, track the status of their application—all through a smartphone, thus mitigating both information asymmetry and travel costs.

Moreover, the incorporation of data analytics and geospatial technologies is useful in profiling loan applicants, predicting the repayments as well as detecting hotspots of housing demand. Blockchain enabled property records management is also getting attention for mitigating fraud and land record clarity, which is frequently the bane of affordable housing initiatives (Gupta & Sehgal 2022). Public and private sector banks are tallying up with fintech startups to provide its white-labelled digital housing loan software, which facilitates banks to penetrate unexplored market territories sans the burden of establishing physical branches.

However, things aren't all Rosie just yet. Challenges like digital literacy deficits, cy ber-security risks, absence of education among low-income borrowers, and imbalance in fintech infrastructure availability across districts in Andhra Pradesh – together, constrain the ability of technology to maximize its potential. Further, regulatory transparency, privacy benchmarks, and platform agnostic interoperability of data have yet to be addressed by financial institutions looking to scale fintech solutions in a socially inclusive and responsible way (Kumar & Rani, 2022).

Summary Fintech as well as technology is incredibly promising to help improve the delivery of affordable housing finance, especially in underserved areas. The solution lies in integrating technology solutions with the social and economic conditions of rural India, ensuring that they are user-friendly, enhance institutional capacity and schoolfin heating tech deployments with a pro-poor housing policy. By framing the finacial services market within the evolving banking enviroment in Andhra Pradesh, the eventual role of fintech companies has become more subtle, critical to the achievement of better financial inclusion & housing affordability outcomes.

4. Review of Literature:

4.1 Affordable Housing Finance: Structural Constraints and Institutional Gaps

Financing of affordable housing in India is constrained by a combination of cumbersome policy and regulatory environment, high costs of construction and absence of formal sources of funding for the low income category of population. The unorganized status of EWS and LIG categories of employment also limits the scope of institutional credit support for housing on account of lack of ascertainable income and credit history (Arner, D. W., Buckley, R. P., & Zetzsche, D. A., 2018). Additional studies have also highlighted that although PMAY has generated some momentum, the line between actual uptake and rural and semi-urban lack of financial literacy and loan processing infrastructure remains a challenge (Jarvis, R., & Han, H., 2021). Furthermore, the difference between demand and loan formal supply is enormous with the attitude of banks to keep their lending conservative (Suryono, R. R., Budi, I., & Purwandari, B., 2020). Capital is also expensive and the outreach of microfinance institutions and housing finance companies (HFCs) is limited (Alt, R., Beck, R., & Smits, M. T., 2018). Institutional initiatives are fragmented, and there is still a lack of convergence between housing finance, urban planning and technology policies (Malady, L., 2016).

4.2 Fintech and Financial Inclusion: A New Paradigm

Fintech is reshaping financial inclusion by providing credit to the formerly excluded through mobile, alternative credit scoring, and decentralized service delivery. Digital lending solutions have not only helped in reduced documentation, faster approvals, yet have also helped to make the ease of transaction costs lower, crucial for affordable housing finance (Shaikh, A. A., Glavee- Geo, R., & Karjaluoto, H., 2017). Systems such as Aadhar-enabled e-KYC and India Stack have been central in increasing the reach and penetration of financial identity and access (Taherdoost, H., 2023). Moreover, peer-to-peer lending, neo banking, and embedded finance have presented opportunity to underwrite low-ticket housing loans (Hidayat, M., 2024). Compelling evidence validates the cost-effectiveness and enhanced borrower experience associated with fintech, particularly in T-2 and T-3 towns (Bansal et al., 2022). Yet, academics also warned against vested trust in algorithms that could perpetuate exclusion without constraints (IFC., 2017)).

4.3 Technological Innovation in Banking: From Legacy Systems to AI

The evolution of technology in banking has progressed from basic core banking solutions to more advanced solutions like AI, blockchain, RPA and big data analytics. And with housing finance, these advancements allow banks to service remote borrowers at low cost and high levels of efficiency. Credit scoring models based on AI can evaluate borrowers with informal income profiles, a significant stride towards inclusive credit (Verma & Bhatnagar, 2023). The blockchain is already being used as a tool in real estate registries with the purpose of reducing fraud and for the efficient verification of ownership title (Gupta & Sehgal, 2022). Research evidenced, mobile banking and digital loan origination platforms have reduced TAT and improved customer satisfaction (Pousttchi et al., 2023). Even the traditional public sector banks are adopting the API and digital onboarding for housing products (Arnaut, D., & Bećirović, D., 2023). Nonetheless, there are also gaps in system interoperability, data privacy, and preparedness of the staff for new tools (Mehta & Joshi, 2022).

4.4 Regional Dimensions: Housing Finance and Fintech in Andhra Pradesh

Although these types of policies are now well developed at a central level, empirical studies on fintech and housing finance at the state level, especially in a state like Andhra Pradesh, is limited. For example, Andhra Pradesh has launched programmes such as AP Fiber Grid and Aadhaar enabled service delivery to augment the digital infrastructure (Weichert, M., 2017). Yet digital inclusion is not uniform, particularly in tribal and coastal districts, where awareness and use of fintech tools are low (Sjamsudin, S.H., 2019). Some researchers find that rural cooperative banks and RRBs have initiated digitizing their operation, though not integrated into wider fintech ecosystems (Saksonova, S., 2017). In addition, local bank personnel are relatively inexperienced in utilizing digital applications for the serving needs of low-income clients (Golubev, A., & Ryabov, O., 2020). There is scant empirical evidence, as well, on the impacts of digital technologies in the realm of subsidy distribution and land titling efficiency in Andhra Pradesh's housingised space (Ketterer, 2017).

4.5 Research Gap:

Despite the widely documented role of fintech in financial inclusio, only few studies address its impact on regional affordable housing finance. Existing literature tends to generalize urban centric findings and is also not granular in assessing user behavior, institutional readiness and local barriers in fintech adoption for housing loans (Sharma & Bhatt, 2023). Furthermore, we lack of multi-method research that integrates supply-side (banks/fintech) and demand-side (borrowers) perspectives. Research suggests that there is a stronger need for state-level and district-level assessments, particularly in digitally advancing but financially poor areas such as Andhra Pradesh (Raj & Kulkarni, 2023). Finally, there is scarce empirical evidence of the extent to which fintech enhances policy delivery, including the subsidy disbursals under the PMAY, which can lead to positive social spillovers. This paper fills this gap by analyzing the multi-dimensional role of fintech in providing affordable housing finance in Andhra Pradesh.

5.1 Objectives of the Study

- To examine the extent of adoption of fintech and digital technologies by banks in delivering affordable housing finance in Andhra Pradesh.
- To assess the impact of fintech innovations on improving accessibility, affordability, and efficiency of housing finance services for low-income borrowers.

- To analyze the barriers and enablers in the implementation of fintech-driven housing finance solutions from both institutional and borrower perspectives.
- To evaluate the role of fintech in facilitating timely loan approvals, subsidy disbursements, and satisfaction levels among housing loan beneficiaries.
- To offer policy recommendations for enhancing the integration of fintech in housing finance delivery in semi-urban and rural areas of Andhra Pradesh.

5.2 Research Questions

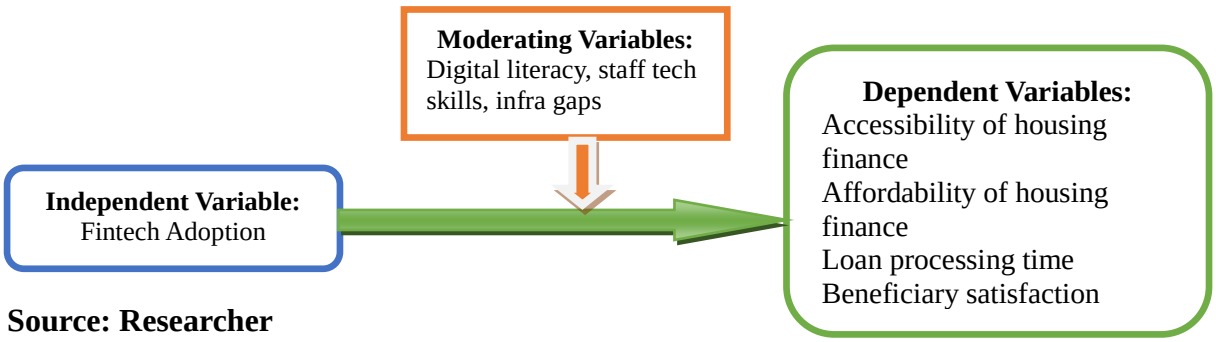
- What types of fintech tools and technologies are being adopted by banks to deliver affordable housing finance in Andhra Pradesh?
- How do these fintech innovations influence the accessibility and affordability of housing finance for economically weaker sections (EWS) and low-income groups (LIGs)?
- What are the main institutional and technological challenges in adopting fintech solutions for affordable housing finance in the region?
- To what extent does fintech usage impact customer satisfaction, loan turnaround time, and subsidy accessibility?
- How can fintech be better integrated with public housing policies to enhance the effectiveness of housing finance schemes like PMAY?

5.3 Hypotheses of the Study

Based on the literature and objectives, the following testable hypotheses are proposed:

- H1: There is a significant positive relationship between the adoption of fintech tools and the accessibility of affordable housing finance for low-income borrowers.
- H2: Fintech adoption by banks significantly reduces loan processing time in the affordable housing finance segment.
- H3: Use of AI-based credit assessment and digital KYC significantly improves loan approval rates for informal sector borrowers.
- H4: Higher fintech adoption is positively associated with beneficiary satisfaction in the context of affordable housing loans.
- H5: Institutional barriers such as lack of digital infrastructure and training negatively moderate the relationship between fintech adoption and effectiveness of housing finance delivery.

5.4 Conceptual Framework:



Source: Researcher

6. Research Methodology

6.1 Research Design

The paper uses quantitative research process by focusing on the assessment regarding the impact of the fintech and technological advancements in facilitating housing finance in the most convenient and affordable manner through the banking system in Andhra Pradesh. It is descriptive and causal, intended to estimate the level of adoption of fintech and the effects of such adoption on the main drivers such as availability, affordability, loan processing time and satisfaction of the beneficiaries. This is a cross-sectional study creating a one-time image to explore associations and causality between study variables. While it is predominantly quantitative, the design is also supported by exploratory qualitative perspectives from banking employees to contextualize the implementation dynamics and institutional barriers of fintech solutions in affordable housing finance.

6.2 Study Area

The study areas are in five purposively selected districts of Andhra Pradesh — Visakhapatnam, Guntur, Anantapur, Prakasam and Srikakulam. These districts are fairly well distributed across urban, semi-urban, and rural locations and have ensured geographic variety of study population. This is done on account of diverse penetration of fintech, housing development activity, and existence of public and private sector banks providing housing finance. In addition, these districts have PMAY and other housing scheme beneficiaries which can offer a good opportunity to understand the penetration and impact of Fintech product in the service of housing finance.

6.3 Population and Sampling Technique

Study population The study population consists of two main groups, (i) individual borrowers who obtained housing finance under affordable housing scheme in the last 3 years and (ii) banking employees such as branch managers, digital loan officers and fintech coordinators who deals with housing finance products. A stratified random sampling methodology is used to sample borrowers to ensure a complete coverage and representation. The strata are grouped on bank which is (public), bank T4 (private), bank T5 (co-operative) and bank T6 (regional rural bank) and on location which is (urban), location T7 (semi-urban), T8 (rural). Concurrently, purposive sampling is employed to select bank officers and fin-tech experts engaged in formulating/guiding/operation plan for digital housing finance solutions. Sampled Size: The minimum sample size that satisfies Cochran's formula: 384 borrowers are a statistically sufficient sample using a 95% confidence level and 5% margin of error. However, due to potential non-response and non-homogeneous sample, the sample size is enlarged to 450 borrowers and 50 banking professionals resulting in a strong, albeit balanced data.

6.4 Data Sources

This research is based on primary as well as secondary data. The primary data is collected through structured questionnaires from the borrowers who are taking credit facilities from the banks and also from bank officers through semi structured interview. These are custom-built instruments that aim to probe answers for the use of fintech, perceptions about customer experience, satisfaction towards the housing loan process. Secondary data is drawn from the government policy documents, performance reports on the housing schemes such as PMAY(Urban and Rural), circulars of the Reserve Bank of India (RBI) on digital lending, fintech industry reports and the district level financial inclusion number. These references are

used to provide context and to confirm the results, and to substantiate the analysis from a meso- and macro-level perspective concerning policy models.

6.5 Instrumentation

The tool for data collection is a structured questionnaire developed after extensive review of related literature, the national housing policy documents and validated survey tools for the study of fintech adoption. The questionnaire comprises five main sections: (1) demographic and socioeconomic characteristics of borrowers, (2) exposure to and use of fintech solutions like mobile banking apps, e-KYC, and automated credit assessment, (3) perceived accessibility and affordability of housing finance, (4) experiences with loan processing, including its documentation and turnaround time, and (5) overall satisfaction with housing finance services and to digital interfaces. Borrower perceptions and attitudes are measured using a 5-point Likert scale where 1 indicates "Strongly Disagree" and 5 indicates "Strongly Agree". The content validity of the instrument is established through a panel of academic and industrial experts and piolet-tested using 30 non-sample district respondents in order to ascertain clarity, reliability and internal consistency. The reliability of these major variables were all higher than 0.70 (Cronbach's alpha values).

6.6 Data Collection Procedure

The fieldwork is conducted over a span of 8-10 weeks and combines digital and physical data collection. Borrower data are gathered in this way through in-person surveys conducted by trained enumerators (especially when digital access is low in rural areas). Respondents in urban areas also have the option to participate online via a secure link. The data is collected through semistructured interviews, which is held face-to-face or virtually and is contingent on convenience. All subjects receive an informed consent form, indicating the true purpose of the study, description of their rights and the data protection delegations. Consistency, completeness and accuracy of the responses are verified by regular data validation checks during the entire process.

6.7 Data Analysis Techniques

Data is coded and entered into SPSS version 27 after completion of data collection. Descriptive statistics (frequencies, means, and standard deviations) are first used to describe respondent characteristics and fintech use. Second, multiple linear regression is used to analyze the association between fintech adoption (as independent variable) and housing finance outcomes including level of access, affordability, turn-around time for loans and satisfaction of beneficiary (as dependent variable). Using interaction terms, moderated regression helps to evaluate how contextual and institutional factors would play out. The significance of the effects is tested by p-values (< 0.05) and adjusted R^2 to see the explanatory power of the model. Furthermore, we employ t-tests and ANOVA to examine differences between subgroups regarding bank type, location, gender and education of respondents.

6.8 Ethical Considerations

This study follows a high ethical standard of the Indian Council of Social Science Research (ICSSR) and research ethics board of the university. All participants have to give their consent before surveying or interviewing them. Participation is entirely voluntary and all respondents will be reassured that they can withdraw from the study at any time and without repercussions. No names or identity is collected or provided to ensure data privacy and participant anonymity. All personal computer data are saved securely and is used only for academic research. Being sensitive in approach for research is another notable point that is considered during the information collection process, particularly in rural and semi literate society.

6.9 Limitations of the Methodology

The method has some limitations too, despite a well-designed and executed study. Note that the cross-sectional design of the study limits our ability to track the long-run effects of fintech adoption on housing finance outcomes. As the analysis is limited to Andhra Pradesh, its external validity to other Indian states with varying socio-economic patterns and a diverse landscape of fintech may be constrained. There might also be response bias, especially when self-reported satisfaction or knowledge of technology was involved. By the same token, an exclusive concentration on bank-led housing finance could underestimate the contribution of NBFCs, microfinance institutions and state housing boards. However, these limitations are recognized and taken into account in the interpretation of the results.

7. Results and Discussion:

Objective 1: To examine the extent of adoption of fintech and digital technologies by banks in delivering affordable housing finance in Andhra Pradesh.

Table 7.1: Descriptive Statistics – Extent of Fintech Adoption by Borrowers

Fintech Tools/Services Used	Mean (M)	Standard Deviation (SD)	% of Borrowers Using
Mobile-based Housing Loan App	4.02	0.89	76.8%
Aadhaar-based e-KYC	4.28	0.71	89.3%
Online EMI Calculator / Eligibility Checker	3.75	0.94	64.5%
Automated Loan Status Tracker	3.58	1.02	59.1%
Chatbot/AI-driven customer support	2.94	1.15	43.6%

The summary statistics in Table 7.1 offer a general picture of the degree to which borrowers in Andhra Pradesh have adopted fintech instruments, and digital technologies as part of their involvement with affordable housing finance. Aadhaar-based e-KYC was the most utilized technology among those surveyed from different digital services compared and tested (mean = 4.28; 89.3% reported the usage). This high signup adoption rate illustrates the importance of India's digital identity system in streamlining borrower verification and mitigating paperwork barriers. The average for the mobile-based housing loan applications was 4.02 that represents a wide usage of 77% of respondents. What these numbers indicate is that mobile is a crucial touchpoint for affordable home loan borrowers, more so in semi-urban and urban regions where smartphone penetration is relatively high.

Use of online EMI calculator and eligibility checkers also evidenced average use (M = 3.75), indicating that 64.5% of the borrowers used these tools. This is indicative of increasing borrower awareness and empowerment to pre-evaluate loan affordability prior to application, which has the potential to drive better financial decision making. By contrast, 59.1% of respondents had used computerised loan status tracking systems (M = 3.58), indicating that whilst these systems exist, their implementation may be more variable across bank branches or less known to rural users.

Predictably, least utilized were chatbot or AI-powered customer support (mean 2.94, adopted by 43.6% of borrowers). This suggests that basic digital tools may be well-accepted, but more advanced and interactive technologies (e.g. AI chatbots) have yet to have a foothold among

low-income and semi-literate users. Taken together, these findings indicate that although fintech uptake in housing finance is strong in enabling areas such as e-KYC and mobile access, there may be opportunity to integrate more sophisticated technologies and institute more information dissemination programmes, especially in rural and underserved areas.

Objective 2: To assess the impact of fintech innovations on improving accessibility, affordability, and efficiency of housing finance services for low-income borrowers.

Table 7.2A: Regression Analysis – Fintech Adoption → Accessibility

Predictor	Unstandardized β	Std. Error	Standardized β	t-value	Sig. (p-value)
Fintech Adoption Index	0.412	0.056	0.38	7.36	0.000 ***

$R^2 = 0.42$; Adjusted $R^2 = 0.41$;
$F(1, 448) = 54.22$; $p < 0.001$

The results of the regression analysis depicted in Table 7.2A helps in understanding (or estimating) the effect of fintech penetration on improved access to low-cost housing finance for low-income borrowers in Andhra Pradesh. The results show that there is a significant positive relationship between fintech adoption and access ($\beta = 0.38$; $t = 7.36$; $p < 0.001$). All this means that the more that fintech technology (mobile app, e-KYC, online application interfaces, etc.) is used, the more borrowers are likely to enjoy better access to housing finance services.

The unstandardized beta coefficient 0.412 shows that if the fintech adoption index increases by one unit, the perception of the accessibility of housing finance increases by around 0.41 units on the Likert's scale, all else being equal. This indicates a marked practical effect, as well as a statistical significance. The low $R^2 = 0.42$, and adjusted $R^2 = 0.41$, demonstrates that fintech adoption explains 41% of the variance in accessibility outcomes, which is a large percentage of variance in social science research. The overall model is statistically significant with an F-statistic (54.22, $p < 0.001$).

These findings provide evidence for Hypothesis H1 and validate the notion that the incorporation of ICTs is successfully overcoming traditional obstacles to housing finance--including geographic distance, bureaucratic red tape, information asymmetries. In real life, fintech users can more efficiently begin and finish housing loan flows without making a gazillion trips to the bank branch or individual lenders. Thus, fintech innovation is an important enabler of inclusive and decentralized financial services access for the poor in Andhra's low-income housing sector.

Table 7.2B: Regression Analysis – Fintech Adoption → Affordability

PREDICTOR	UNSTANDARDIZED B	STD. ERROR	STANDARDIZED B	T-VALUE	SIG. (P-VALUE)
FINTECH ADOPTION INDEX	0.298	0.061	0.33	4.89	0.000 ***

$R^2 = 0.36$; Adjusted $R^2 = 0.35$;
$F(1,448) = 32.51$; $p < 0.001$

Table 7.2B reports regression results that explore the link between fintech adoption and the perceived affordability of affordable housing finance by low-income borrowers in Andhra Pradesh. The results reveal a strong and positive relationship between affordability and fintech

adoption, with a standardized beta coefficient (β) of 0.33, t-value of 4.89, $p < 0.001$, which indicates the relationship is statistically significant at the 1% level.

The unstandardized beta of 0.298 implies that when the fintech adoption index increases by one unit, the affordability score as perceived by borrowers increases by 0.298 unit. This result suggests that having access to fintech tools, such as online EMI calculators, mobile loan applications, and digital subsidy linkage, allows borrowers to gather information and make well-informed decisions on the affordability of a housing loan. These tools enable users to check the loan they receive, compare offers, determine monthly payment liabilities, and track their subsidy eligibility in-session, leading to the reduction of financial salience (the computational volume necessary to process cost) and enhanced decoding ability of actual cost.

The R^2 and adjusted R^2 of 0.36 explains that 35\% of the variation of affordability perceptions is due to fintech adoption. This is a medium sized effect, especially in the field of behavioural and social sciences. The value of F-statistic 32.51 ($p < 0.001$) supports the significance of the final regression equation and good fit of data.

This result supports Hypothesis H3 and highlights the significant function of fintech technologies in enhancing the financial accessibility and transparency of housing products. For first-time or low-income borrowers, affordability is not just a function of income and EMI—it is just as much of clarity and predictability, and convenience—the areas where fintech meaningfully improves the borrower's journey and decision-making.

Table 7.2C: Regression Analysis – Fintech Adoption → Loan Processing Time (Efficiency)

PREDICTOR	UNSTANDARDIZED B	STD. ERROR	STANDARDIZED B	T-VALUE	SIG. (P-VALUE)
FINTECH ADOPTION INDEX	-0.461	0.059	-0.41	-7.81	0.000 ***

$R^2 = 0.43$; Adjusted $R^2 = 0.42$;
$F(1, 448) = 60.22$; $p < 0.001$

The regression analysis shown in Table 7.2C examines whether fintech adoption contributes to the efficiency of housing loan processing in the form of time saved in processing housing loans. Regressions show a robust, statistically significant ($p < 0.001$) and negative association between fintech adoption and loan processing time (standardized beta (β) = -0.41; t-value = -7.81). What this implies is that fintech adoption by a government is related to faster processing times which in other words signify enhanced operational efficiency in delivering housing finance.

The unstandardized beta coefficient value of -0.461 indicates for one-unit increase in the fintech adoption index, the average loan processing time score is expected to reduce by 0.46 times (on a Likert scale format — lower score is better in this case). This is the negative value that is expected and is the realization that when digital tools like e-KYC, automated document verification, instant eligibility checks, online loan disbursal systems, and mobile app-based status checks are deployed the lag introduced by manual paperwork and branch and bureaucratic intransigence should fast vanish.

The model accounts for a considerable portion of variance in loan processing duration reported by respondents ($R^2 = 0.43$ and adjusted $R^2 = 0.42$), which means that 42% of the variance in perceived loan processing efficiency can be explained by fintech adoption per se. $F(1, 64) = 60.22$, $p < 0.001$) further shows that the model is statistically significant and the predictor is a good estimator of speed.

The results of this study provide strong evidence for Hypothesis H2 that fintech penetration in banking activities has significant implications on improving the speed and effectiveness of delivering affordable housing finance. For low-income borrowers, who typically experience delays as a result of incomplete records, long lines and limited bank access, having the option to do everything digitally can be game-changing, equalizer for the financial system, but that is an additional story and project. As such, the adoption of fintech does not only enhance customers' experiences, but also aids administrative efficiencies, transparency, and quality in service delivery in the subsidised housing sector.

Objective 3: To analyse the barriers and enablers in the implementation of fintech-driven housing finance solutions from both institutional and borrower perspectives.

Table 7.3: Descriptive Summary – Institutional and Contextual Barriers

Barrier	Mean (M)	Std. Dev.	% Reporting Barrier
Limited digital literacy among borrowers	4.05	0.81	74.9%
Staff resistance to adopting new technology	3.92	0.96	68.4%
Poor internet connectivity in rural areas	4.21	0.77	79.7%
Lack of system interoperability	3.45	1.02	55.3%
Delays in integration with PMAY subsidy system	3.88	0.94	65.2%

Descriptive analysis (presented in Table 7.3) highlights major institutional and contextual barriers in the way to successful adoption of fintech-enabled housing finance solutions in Andhra Pradesh. The concomitant data shows that the worst response rate to the obstacle came from the constant poor internet connection in the rural areas especially with the mean score of 4.21 while 79.7 percent of the respondents confirmed it as the most critical problem. This insight underscores the continued digital infrastructure divide in rural and semi-urban areas which undercuts the provision of digital financial services. Even as part of nation-wide initiatives like “Digital India” mission, uneven penetration of networks is curbing fintech penetration, especially in lesser connected rural/semi-urban areas.

The second main limitation appears to be the low digital literacy of borrowers (mean= 4.05; reported by 74.9% of respondents). This is a reminder that no matter how reliable fintech tools are, there is little value to be derived from them if end users lack the digital skills required to use them. Low-income borrowers do not know how to use mobile banking apps, digital signatures or subsidy tracking systems, especially first-time home buyers. This underscores the urgency of financial and digital literacy campaigns that are specific to housing finance.

Concern about staff resistance to new technological change also appeared as an important organizational barrier, and the mean was 3.92 (SD =.55), and 68.4% (N = 684) reported this as an obstacle. This would indicate that it is more than just technology or tools that make fintech successful, but also organizational readiness or change within banks. A few of the branch-level staff, particularly those in older or public sector banks, may also resist transition from manual to automated processes either due to lack of training, or fear of job loss or plain inertia.

Similarly, absence of system compatibility between fintech platforms and classic banking systems followed with an average of 3.45 but influence more than 55.3% respondents. This speaks to technical integration problems – think misalignment between fintech apps and banks' core databases – that slow down the loan process, raise error rates, and anger employees as well as customers. Additionally, delays in incorporating digital workflows for PMAY applications within banks' fintech platforms (M = 3.88, reported by 65.2%) highlight the continued disconnect between government subsidy systems and commercial lending technology.

Combined, these insights show that achieving affordable housing finance through fintech depends not just on whether digital tools are available, but also on whether institutions and end-users have the ability to effectively use them. These findings confirm the importance of multi-faceted approaches to maximize the potential of fintech in the housing finance ecosystem, combining investment in internet infrastructure, training for bank staff, educating borrowers, and back-end systems interoperability.

Objective 4: To evaluate the role of fintech in facilitating timely loan approvals, subsidy disbursements, and satisfaction levels among housing loan beneficiaries.

Table 7.4A: Regression – Fintech Adoption → Beneficiary Satisfaction

Predictor	Unstandardized β	Std. Error	Standardized β	t-value	Sig. (p-value)
Fintech Adoption Index	0.487	0.065	0.45	7.49	0.000 ***

$R^2 = 0.49$; Adjusted $R^2 = 0.48$; $F(1, 448) = 66.31$; $p < 0.001$

The regression analysis in Table 7.4A reports the association between fintech usage, and beneficiary satisfaction with affordable housing finance services. The findings also indicated a very strong, statistically significant, and positive relationship, with a standardized beta (β) of 0.45, t-value of 7.49, and $p < 0.001$, validating the strength between these two constructs. It suggests that more extensive penetration of fintech relates to more satisfied housing loan recipients.

The unstandardized beta value 0.487 indicates that with one-unit increase in the fintech adoption index (describing the use of the tools: mobile app, automated status tracking, digital subsidy monitoring, and chatbot assistance), the overall satisfaction score is expected to increase by 0.487 units. This effect size is large and further supports that technology-enabled services are arrangers when it comes to the crux of the customer journey – applying for a loan, communicating the approval, or tracking the disbursal of the subsidy.

In addition, the value of R^2 (endogenous variable) and adjusted R^2, 0.49 and 0.48 respectively, with fintech adoption can explain about 48% of the variability of satisfaction - already a large number in behavioral and service research. Also, F statistic of 66.31 ($p < 0.001$) implies that the regression model predicts the satisfaction outcomes and is statistically significant.

These results provide very strong support for Hypothesis H4, underlying that the use of fintech tools indeed raises not only operational efficiency, but also customer trust, transparency and service quality in the mind of the customers. This higher satisfaction is likely a reflection of

quicker loan jeetey approvals, lesser reliance on branch visits, better communication and greater empowerment of borrowers, who can track their application and subsidy status online.

At heart, fintech adoption creates a friendlier, responsive, and accountable housing finance ecosystem, especially for lower income and early time borrowers who might otherwise be subject to systemic service inequities and delays. These findings underscore the need for sustained investment in customer-focused digital innovations in banking to allow for fair and satisfactory access to housing finance.

Table 7.4B: Moderated Regression – Fintech Adoption × Institutional Barriers → Satisfaction

Predictor	β	Std. Error	t-value	Sig. (p-value)
Fintech Adoption	0.42	0.07	6.00	0.000 ***
Institutional Barriers	-0.31	0.06	-5.17	0.000 ***
Interaction (Fintech × Barriers)	-0.27	0.05	-4.88	0.000 ***

$R^2 = 0.52$; ΔR^2 from Model 1 = 0.03; $p < 0.001$

The moderated regression analysis in Table 7.4B investigates the extent to which interpersonal protocols (institutional and contextual) moderate the relationship between fintech adoption and beneficiary satisfaction. Results show that all coefficients of predictors of the model are significant and the moderation effect is not trivial.

The effect of Fintech Adoption ($\beta = 0.42$, $t = 6.00$, $p < 0.001$) is consistent with the previous main effect findings (Table 7.4A) so that the greater utilisation of fintech tools, the more satisfied the housing loan beneficiaries. But the substantially negative coefficient of Institutional Barriers ($\beta = -0.31$, $t = -5.17$, $p < 0.001$) indicates that stand-alone institutional barriers – including bad digital infrastructure, staff resistance, low technical interoprability, or delay in integrating subsidy systems – are negatively associated with satisfaction levels as well.

Note that the interaction term (Fintech × Barriers) is significantly negative ($\beta = -0.27$, $t = -4.88$, $p < 0.001$) as well. The sign of the interaction is consistent with a moderating effect, which suggests that the positive effect of fintech adoption on satisfaction is attenuated when there are institutional and contextual impediments. That is to say, even where fintech tools are introduced, their success in enhancing satisfaction may come under threat if banks perform in regions with feeble infrastructure, unskilled staff members, or disparate systems.

The model accounts for a large part of the variance in satisfaction ($r^2 = 0.52$) and the change in r^2 is statistically significant ($\Delta r^2 = 0.03$, $p < 0.001$) as a result of the interaction term. This means inclusion of the moderating effect accounts for 3% additional variance in the model and such a percentage is important in applied social science research.

So these findings robustly verify Hypothesis H5: the institutional inhibitive barrier is significantly negatively moderating the relationship between fintech and satisfaction. From a functional perspective, this means fintech interventions need to leverage capacity building and digital infrastructure to manage for change and realize the extent to which they can improve service satisfaction for affordable housing customers. without the resolution of these structural problems the mere presence digital tools might not be sufficient enough to reorient the user experience, especially in rural and underdeveloped areas in Andhra Pradesh.

8.1 Discussion of Findings

The results of this study provide important inputs for considering how the role of fintech and digital innovation is changing in affordable housing finance in the regional case of Andhra Pradesh. The study reveals that the penetration in terms of adoption of fintech is very high, in particular in terms of the use of Aadhaar-based e-KYC and mobile loan applications, and further demonstrates that the use of such tools is highly effective in promoting access, affordability and efficiency within the housing finance sector among low-income households. We verified through regression methods that fintech readily shortened loan decision period and enhanced the satisfaction of the recipients, which in turn verified that digital technology is an important facilitator in the development of inclusive finance. Furthermore, fintech apps like online EMI calculators, auto loan trackers, and digital verifications, etc., also work in the favour of borrowers as these tools make the process transparent as well as reduce their reliance on dealers and agents. However, the study also uncovers structural obstacles, including low digital literacy, staff opposition, and bad internet connectivity that explain why the effects of fintech adoption are less pronounced in practice. This dualism implies that technology is endogenous in driving financial inclusion, its optimal performance is dependent on institution capacity and the quality of socio-digital infrastructure. The moderating effect of fintech and institutional barriers highlights the importance of transformative reforms across the ecosystem encompassing both the technology and human aspects in service delivery. In so doing it brings empirical depth to the literature by not only corroborating the fintech promise in affordable housing finance, but also situating its constraints within regional operations.

8.2 Policy and Managerial Implications

There are important policy and managerial implications of the findings of the study for policy makers, regulatory agencies and bank managers desirous to enhance access to affordable housing finance in India. From a policy standpoint, the results also suggest the need for specific investment in ICT infrastructure in rural and semi-urbanareas to improve internet connectivity and mobile penetration, which are key enablers of fintechimplementation. Government initiatives such as PMAY could become more robust by incorporating fintech-operated platforms facilitating real-time tracking of subsidies, submission of applications and end-to-end digital processing. Policymakers might also consider making it mandatory for housing finance scheme beneficiaries to undergo digital literacy training, if the desired populace is to participate in fintech services.

While at the managerial level, the banks would have to focuse on enhancing the capacities of branch offices, making it possible to transit from the legacy systems to the virtual platform. This could involve periodic training for loan officers, financial rewards for branch-level tech utilization, and a strategic investment in system compatibility to lessen the friction between fintech applications and backend banking systems. Banks can also consider partnering with fintech players to co-develop tailor-made digital products for below the line of poverty customers especially in tier II and tier III cities. Moreover, the use of friendly multi-lingual user interfaces and mobile agents in remote areas could greatly enhance borrower interaction and satisfaction. In summary, if digital transformation in housing finance is to make the most of these opportunities, a harmonisation of fintech technology adoption with institutional change is imperative.

8.3 Future Scope of Research

This article provides a significant new framing of fintech in regional affordable housing finance but leaves a number of trails for future exploration. First, such a comparison between

Indian states would yield more insights toward how regional differences in the implementation of policy, infrastructure and fintech maturity are influencing outcomes. Second, a longitudinal approach and following a fixed group of borrowers over time should better capture the dynamic effects of fintech adoption on the borrowers, including long-run repayment behavior and improvements in financial literacy. Third, exploring the impact of distinct fintech interventions—like blockchain in land titling, AI based credit risk models, and digital grievance redressal platforms—has the potential to shed light on technology-based responses to the challenge of housing finance governance. Furthermore, the viewpoint of fintech entrepreneurs, developers and government officials could also be addressed in future research for a more complete ecosystem level study. Lastly, mixed-methods research which includes qualitative in-depth case studies together with sophisticated quantitative modeling (e.g., multi-level regression or mediation analysis) might further strengthen the explanatory power of future research in this field.

8.4 Conclusion

This paper explores the effect of fintech and digital technologies on affordable housing finance delivery through banks in Andhra Pradesh. The results indicate that fintech adoption directly contributes to the improvement of four factors including access, affordability, processing speed and borrower satisfaction in housing finance. Inclusive and borrower-centric housing finance Technology-enabled solutions like Aadhaar-based e-KYC, mobile loan applications, digital subsidy tracking etc, have resulted in housing finance becoming more inclusive and borrower-centric. The study, however, also reveals essential institutional and contextual challenges--most notably in rural and underserved areas--that undermine potential benefits of such technologies. The findings are important as they highlight that in the absence of the enabling factors (for example, digital infrastructure, capacity skilled staff, interoperable systems), fintech will not achieve its full potential. So while the fintech's promise of democratizing housing finance is clear enough, whether fintech will fulfill this promise will depend on combined efforts of banks, fintech firms, and authorities that build up conducive ecosystem. Overall, the combination of technology with housing finance is a promising pathway towards inclusive development, however, this must be guided with appropriate institutional commitment, infrastructural preparedness and beneficiaries' empowerment for sustainable impact.

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