

Original Research Article

Adoption of AI-enabled Digital Banking Empowering Informal Women-Led MSMEs in Mumbai Suburbs

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Abstract

The research study seeks to investigate the adoption of Artificial Intelligence enabled digital banking on micro, small and medium enterprises led by women in Mumbai suburbs. Though AI is transforming the banking and financial services by improving easy access to banking services, efficiency and security, still informal MSME'S faces lack of reach of such services due to various infant stages especially among women entrepreneurs.

The proposed study aims to identify the vast potential in the MSME sector undertaken by women particularly in Mumbai suburbs. The area under study have limited access to digital banking and financial services. Though MSMEs form the backbone of developing and developed nations, yet there is a constant barrier in adopting digital banking services.

This paper investigates the transformative role of AI enabling for easy digital banking accessibility in their day-to-day financial transactions especially cross-sectional groups. The study evaluates the readiness of technology adoption, organizational compatibility and perceived trust with special reference TAM (Technology Acceptance Model) integration in women-led MSMEs.

The study explores the level of awareness about AI it is ways to AI adoption, and enabling factors in it and its outcome on MSMEs performance. Adoption correlates positively with women entrepreneurs, digital literacy, access to finance and supportive local networks.

The research study more specific to the Mumbai suburban area. Most of the MSMEs run by women entrepreneurship are informal in doing business. They lack proper documentation related to their business and financial transactions. Sometime this may lead to bias. Due to the current significant development of Artificial Intelligence in the financial sector the research study related to adoption may tend to shift to other newer features.

The study concludes by developing a comprehensive framework showing the drivers influencing the adoption of AI in digital banking among the women-led entrepreneurs. Further in the research it provides insights to the policy makers to consider the women-led entrepreneurs requirements in their financial polices

Keywords: Artificial Intelligence (AI), Digital banking, MSME, TAM (Technology Acceptance Model) integration.

1. Introduction

1.1 Micro, Small and Medium Enterprises (MSMEs)

MSMEs in India play an important role in promoting entrepreneurial growth and business innovation especially in Urban region of Mumbai. MSMEs are a backbone of India's economy. Official Ministry of MSME reports estimated over **63 million (6.33 crore) MSMEs** across India (annual reports 2023–24, 2024–25) with roughly half in urban areas highlighting the scale and importance of urban microenterprises. Maharashtra (and Mumbai) are among the leading states/districts in MSME activity, with local MSME institutes maintaining district profiles and data.

1.2 Women entrepreneurship

Women entrepreneurs in India are a powerful growing force in the national economy, contributing to both the formal and informal sectors. India's MSME sector has approximately 20% female ownership, primarily in micro-enterprises, which face challenges such as limited capital but are resilient, with government schemes (Udyam, procurement mandates) and support bodies known as Confederation of Indian Industry (CII) and International Finance Corporation (IFC) assisting growth, though significant gender gaps persist in employment and scaling, necessitating a focus on mentorship, finance, and infrastructure.

Table 1.3.1 No. of registration in Udyam Registration portal (1st July 2020 to 31st Jan 2024)

Category	MSMEs	Women MSME	%age of Women Owned MSMEs
Total	22,819,417	4,667,278	20.5%

Source: <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2002574®=3&lang=2>

1.3 Artificial Intelligence (AI) in Digital Banking

In recent years, development of Digital Banking has emerged as a critical driver of women's empowerment in developing nations. While Digital Banking deals with the access of financial services with digital platforms like mobile money and e-commerce, AI-enabled Digital Banking uses intelligent technology like smartphones, app, and artificial intelligence (AI) to make faster, easier and personalized financial services. This has witnessed significant growth for entrepreneurship due to the ecosystem support to promote the start-ups and many informal businesses

particularly Micro, Small and Medium, enterprises (MSMEs) especially among women. AI-enabled Digital banking also helps in building credit histories, thereby making it easier for informal businesses like MSME's undertaken by women to access loans and microfinance. Also it enables the informal sectors like MSME's to reduce the transaction costs at greater convenience and thereby enhancing women empowerment. Further AI-enabled digital banking strengthens formal financial services more accessible, affordable and reliable for women entrepreneurship.

2. Literature Review

2.1. Review of Literature on Digital Banking

Kushwaha, D., & Malpani, D. (2025) The study emphasizes how, properly expanded and regulated, digital banking may promote inclusivity. Supporting the fintech ecosystem and guaranteeing internet and device access are the policy implications. The use of digital banking has the potential to significantly increase inclusion in slum environments.

Gulia, A., & Singh, L. (2025) used a Meta UTAUT model to investigate rural Haryana, India residents' adoption of UPI digital payments. According to the results, but attitude is more influenced by social factors than by direct intention. For payment systems in remote locations, the authors suggest agent support and focused awareness.

Onuegbu et al. (2025) examined the use of digital banking in Southeastern Nigeria during the financial crisis. Usage was significantly impacted by elements like accessibility, digital literacy, and trust.

2.2 Review of Literature on Financial Inclusion

Helali et al. (2025) investigated how digital financial inclusion affected regional economic growth and environmental sustainability in China. The study discovered that access to technology and infrastructure were essential, but insufficient; true adoption was based on trust and literacy.

2.3 Review of Literature on Financial Inclusion with Artificial Intelligence (AI)

Pranitasari et al. (2026) proposed a gender based sustainable tools to investigate the relationship between digital inclusion and financial inclusion among women-led MSMEs in Indonesia. The study highlighted that business sustainability is possible as there is an integrated support of digital capabilities, financial access and institutional support. It also emphasized on empowering women entrepreneur's participation in the formal financial system through digital technologies. However, there is a lag in study as it did not specifically investigate the role of Artificial Intelligence (AI) in promoting financial inclusion.

Kumar et al. (2026) investigated the impact of Artificial Intelligence on SMEs led by women entrepreneurs in rural India. According to the study, adoption of AI enhanced business decision making, operational efficiency, productivity and customer engagement. Though the research primarily focused on business performance, it did not explore much on AI's contribution to financial inclusion or digital banking adoption.

Akhtar et al. (2026) investigated the factors influencing women's adoption of Fin Tech payment services by examining the roles of personality traits, financial services knowledge, and Artificial Intelligence. The study concluded that AI and financial knowledge positively influence the adoption of digital payment services and AI driven Fin Tech solutions can encourage women's participation. However, the study could not examine the broader aspects of financial inclusion among women-led MSMEs.

Patra, R., & Ali Abbas (2026) discovered the impact of digital technology adoption on women-led MSMEs in Karnataka. Though the study explored that adopting digital technologies significantly enhanced business productivity, competitiveness and enterprise growth, but it did not specifically examine AI – enabled financial services or their role in improving financial inclusion among informal women entrepreneurs.

3. Research Gap

- Mumbai Suburban has historical data on women entrepreneurs, but not current district-level evidence on their use of AI-enabled digital banking.
- MSME registration datasets do not fully cover informal enterprises, which are central to this study.
- RBI data capture digital-payment growth at an aggregate level, but do not identify women-led informal MSMEs by district.

4. Research Objectives

- To explore the women-led and micro-enterprise ecosystem in Mumbai Suburban using official secondary data.
- To assess digital finance readiness for informal women led MSMEs using the RBI data such as digital-payment growth.
- To examine financial inclusion, and digital transaction capability as foundations for AI-enabled banking adoption.

5. Research Methodology

The present study adopts a secondary data based research methodology to examine the broader ecosystem within the informal women led micro, small and medium enterprises operate and access digital financial services.

The study focuses specifically on Mumbai Suburban District, Maharashtra, and seeks to establish the relationship between the women-led enterprise ecosystem, financial inclusion, digital finance readiness, digital transaction growth, and the emerging relevance of AI enabled digital banking.

The use of secondary data is particularly appropriate because informal enterprises are not comprehensively captured in conventional MSME registration databases. Registered MSME datasets primarily represent enterprises that have entered the formal registration system. Whereas, a substantial proportion of micro and women-led enterprises operate outside formal registration mechanisms. Therefore, the study combines district level administrative data with national and state level datasets covering unincorporated enterprises, financial inclusion and digital payments.

The secondary data analysis is intended to provide the contextual and structural foundation for understanding whether the economic and digital environment in Mumbai Suburban is conducive to the adoption of AI enabled digital banking by informal women-led MSMEs.

The study does not treat aggregate digital payment growth as direct evidence that informal women entrepreneurs are using AI enabled banking services. Rather, such indicators are interpreted as measures of the digital finance environment and adoption readiness within which women-led enterprises operate.

Research Design

The study follows a descriptive and exploratory research design based on secondary data to examine the entrepreneurial, financial, and digital-finance ecosystem relevant to informal women-led MSMEs in Mumbai Suburban.

The descriptive component focuses on profiling the women-led entrepreneurial ecosystem, the registered MSME structure, the predominance of micro enterprises, the scale and characteristics of unincorporated enterprises, women's participation in unincorporated economic activities, the growth of digital transactions, and the changing level of financial inclusion.

The exploratory component examines how these indicators collectively reflect the broader digital finance readiness and potential of informal women led MSMEs to adopt digital banking and, increasingly, AI-enabled banking services.

A multisource secondary data framework has been adopted because no single official database currently provides comprehensive district level information that simultaneously captures women led informal MSMEs, digital banking adoption, AI enabled financial service usage, digital literacy, financial inclusion, and business empowerment.

Therefore, the study triangulates evidence from multiple official sources, including the Sixth Economic Census, MSME / Udyam data, the Annual Survey of Unincorporated Sector Enterprises (ASUSE), Reserve Bank of India (RBI) payment system and financial inclusion data, and Maharashtra Directorate of Economics and Statistics data.

The integration of these sources enables the study to establish the existing entrepreneurial and digital financial context of Mumbai Suburban while identifying the limitations in available secondary evidence and providing a basis for examining AI enabled digital banking adoption and its potential contribution to the financial and business empowerment of informal womenled MSMEs.

Secondary Data Source	Major Variables/Information Used	Relevance to the Study
Sixth Economic Census, Maharashtra	Women entrepreneurs/establishments and historical enterprise profile	Provides a historical baseline for women's entrepreneurship
MSME Dashboard / Udyam-Udyog Aadhaar data	Registered MSMEs and enterprise-size classification	Establishes the formal MSME ecosystem in Mumbai Suburban
ASUSE 2023–24 and 2024–25	Unincorporated manufacturing, trade and service enterprises and female participation	Provides the most relevant official national/state context for informal enterprises
RBI Annual Report / Payment Systems Data	Digital transaction growth and payment-system indicators	Measures the expansion of the digital-finance environment
RBI Financial Inclusion Index	Financial-access and inclusion conditions	Indicates the development of the financial-inclusion ecosystem
Maharashtra Directorate of Economics and Statistics	Demographic and district-level economic context	Provides contextual information about Mumbai Suburban

Data Analysis and Findings

• Historical Women Entrepreneurship Base

The Sixth Economic Census provides an important historical baseline for understanding women's entrepreneurial participation in Mumbai Suburban. The available data indicate approximately 48,428 women entrepreneurs establishments in Mumbai Suburban.

This figure demonstrates that women's participation in entrepreneurial and economic activity in the district is not a recent phenomenon. Mumbai Suburban has a substantial historical base of women-led economic activities, providing an important foundation for examining the subsequent transition toward digital financial services.

However, the Economic Census data are historical and therefore cannot independently establish the present level of digital-banking adoption among women entrepreneurs. The data are consequently used as a baseline indicator rather than as a measure of current adoption.

Finding

The historical presence of approximately 48,428 women entrepreneurs indicates a significant women-led enterprise base in Mumbai Suburban. However, the absence of recent district-level information linking these enterprises with digital banking creates an important research gap.

• Registered MSME Ecosystem in Mumbai Suburban

The MSME / Udyam related data indicate a large registered enterprise ecosystem in Mumbai Suburban, with approximately 520,351 registrations reported in the dataset used for this study.

The available enterprise-size information indicates that the district is strongly dominated by micro enterprises. The reported figure of approximately 510,406 micro enterprises suggests that micro-enterprises constitute the overwhelming majority of the registered MSME ecosystem.

This finding is particularly relevant to the present study because women-led informal enterprises are generally more closely associated with the micro-enterprise segment than with medium-sized businesses.

The predominance of micro-enterprises indicates that digital financial solutions designed for small scale entrepreneurs including mobile banking, UPI-based payments, digital credit, automated financial management, fraud alerts and AI assisted financial services may have considerable potential relevance to the district.

Finding

Mumbai Suburban has a large registered MSME base that is predominantly micro-enterprise oriented. This provides a strong structural basis for examining the potential role of digital banking in supporting small-scale entrepreneurial activities.

• Importance of the Informal and Unincorporated Enterprise Sector

The registered MSME data alone cannot adequately represent the enterprise population relevant to this study because many micro-enterprises operate without formal registration.

The Annual Survey of Unincorporated Sector Enterprises (ASUSE) provides a particularly important source for understanding this segment. ASUSE covers non-agricultural unincorporated enterprises engaged in

manufacturing, trade and services and therefore provides a much closer statistical representation of the informal business environment.

The available ASUSE evidence indicates that the number of unincorporated enterprises in India increased from approximately 7.34 crore in 2023–24 to about 7.92 crore in 2024–25.

This increase demonstrates the continuing economic importance of the unincorporated sector. For the present study, the significance of ASUSE lies not in treating national figures as direct estimates of Mumbai Suburban enterprises, but in establishing the broader economic importance of the informal enterprise sector.

Finding

The substantial size of India's unincorporated enterprise sector confirms that formal MSME registration data cannot be used as the sole basis for studying informal women-led enterprises. This supports the methodological decision to supplement registration data with ASUSE and other secondary sources.

- **Women's Participation in Unincorporated Enterprises**

The ASUSE findings further demonstrate the substantial participation of women in unincorporated economic activities. The reported proportion of female-headed establishments in manufacturing was approximately 58% in 2023–24, increasing to approximately 60.4% in 2024–25 in the data used for this study.

This evidence is important because it demonstrates that women have a substantial role in the unincorporated enterprise sector. Such participation strengthens the relevance of investigating whether digital financial technologies can improve women's ability to manage business transactions, access financial services and make financial decisions.

However, the ASUSE figures represent broader national/state-level conditions and should not be interpreted as the percentage of female-headed enterprises specifically within Mumbai Suburban.

Finding

The substantial participation of women in unincorporated enterprises provides strong contextual justification for examining digital financial inclusion and digital-banking adoption among women-led informal enterprises.

- **Growth of Digital Transactions in India**

Digital payment systems have experienced substantial growth in India. The RBI data used in this study indicate a 52% compound annual growth rate (CAGR) in the volume of digital transactions during 2013–14 to 2023–24.

The digital-payment ecosystem continued to expand during the subsequent period, with digital transaction volumes reaching a reported milestone of approximately 22,831 crore transactions during FY 2025–26 in the data considered for this research.

The rapid expansion of digital transactions indicates that digital financial services have become an increasingly important component of India's financial infrastructure.

Nevertheless, aggregate transaction growth should not be equated with adoption by informal women entrepreneurs. RBI data are generally aggregated at the system level and do not identify whether a particular transaction was made by a woman entrepreneur, an informal MSME or a registered MSME.

Finding

The rapid growth of digital transactions establishes a strong digital-finance environment in India. However, the absence of district-, gender- and enterprise-level transaction data represents an important evidence gap for Mumbai Suburban.

Overall Finding

The secondary data collectively indicate that Mumbai Suburban operates within a large, micro enterprise dominated and increasingly digital financial environment.

The historical Economic Census evidence establishes a meaningful women-led entrepreneurial base in the district. The MSME registration data further indicate the presence of a large formal enterprise ecosystem dominated by micro-enterprises.

At the same time, the ASUSE data demonstrate that a considerable proportion of India's economic activity occurs through unincorporated enterprises. This is particularly important for the present study because informal women-led enterprises may remain outside conventional MSME registration databases.

The expansion of digital transactions and improvement in financial inclusion provide evidence that the broader Indian financial ecosystem is increasingly supportive of digital financial services. This creates an enabling environment for women entrepreneurs to move from cash-based financial practices towards digital banking.

However, the secondary evidence also reveals a critical limitation in existing datasets. The available official statistics do not jointly identify women-led informal MSMEs in Mumbai Suburban and measure their use of AI-enabled digital banking.

This produces an important distinction between digital finance ecosystem readiness and actual enterprise-level adoption.

The secondary evidence can establish that:

The economic base exists, the micro-enterprise sector is substantial, women's participation is significant, digital transactions are growing rapidly, and financial inclusion is improving.

However, it cannot independently establish:

whether informal women led MSMEs in Mumbai Suburban are actually adopting AI enabled digital banking, what factors influence their adoption, or whether such adoption results in measurable business empowerment.

These unanswered questions provide the empirical justification for the primary research component of the study.

Conclusion

The secondary-data analysis demonstrates that Mumbai Suburban represents a relevant setting for investigating the adoption of AI-enabled digital banking among informal women-led MSMEs.

The available evidence indicates the presence of a substantial historical women-led entrepreneurial base, a large registered MSME ecosystem dominated by micro enterprises, and a much broader unincorporated enterprise sector that is not completely represented in formal MSME registration datasets.

At the national level, the continued expansion of digital transactions and improvement in financial inclusion indicate that the Indian financial environment is increasingly supportive of digital financial services. These developments create favourable conditions for women entrepreneurs to use digital banking for business transactions, financial management and access to financial services.

However, the analysis also identifies a significant information gap. Existing official secondary datasets generally provide information either on enterprises, women entrepreneurs, digital payments or financial inclusion, but do not provide an integrated district-level measure of AI-enabled digital banking adoption among informal women-led MSMEs.

Therefore, secondary data establish the context and readiness of the ecosystem, but they cannot adequately measure actual AI-enabled banking adoption or its impact on business empowerment.

The findings consequently justify the need for primary empirical research among women-led informal MSMEs in Mumbai Suburban. The primary study can investigate factors such as awareness, digital literacy, financial literacy, trust, perceived usefulness, ease of use, security, behavioural intention, actual usage and business/financial empowerment.

Accordingly, the secondary-data findings provide a strong foundation for the subsequent primary-data analysis and help establish the relevance and originality of the proposed research.

Limitations

The historical Economic Census provides an important baseline; however, it does not provide sufficiently current evidence regarding the present population and digital-banking behaviour of women entrepreneurs in Mumbai Suburban.

Udyam / Udyog Aadhaar registration data primarily capture registered enterprises. Informal businesses that have not registered may therefore remain outside the database.

RBI payment-system statistics provide information about digital transactions but generally do not distinguish between conventional digital banking and AI-enabled banking applications.

Overall

The most important implication emerging from the secondary-data analysis is that India's digital finance infrastructure is developing rapidly, but the availability of granular evidence about its adoption by informal women-led MSMEs remains limited.

The study therefore addresses a specific evidence gap by moving beyond aggregate digital-payment statistics and examining the enterprise level experience of women entrepreneurs in Mumbai Suburban.

The secondary-data component establishes the “ecosystem readiness”, while the primary-data component can establish the “actual adoption and empowerment relationship.”

This distinction strengthens the methodological justification of the research and avoids making an unsupported claim that growth in India's digital transactions automatically represents adoption of AI-enabled digital banking by informal women-led MSMEs.

Reference

- Kushwaha, D., & Malpani, D. (2025). The Impact of Fintech on Financial Inclusion in India: An Empirical Analysis of Digital Payment Adoption and Banking Access. *International Journal of Environmental Sciences*, 11(12s), 218-227.
- Gulia, A., & Singh, L. (2025). *Adoption of UPI by Rural People: An Empirical Investigation*. *IITM Journal of Business Studies*.
- Onuegbu, O. C., Agbamu, B. O., Anyakoha, B. U., & Anunike, O. W. (2025). *Communication, awareness and acceptance of digital banking amidst cash crunch in South-East and South-South Nigeria*. *arXiv Preprint*. Helali et al. (2025)
- Pranitasari, D., Suriawinata, I. S., & Warcito, W. (2026). A gender-sensitive sustainable model of digital and financial inclusion for women-led MSMEs in Indonesia. *Frontiers in Human Dynamics*, 8, 1795115.
- Kumar, R., Sharma, R., & Srivastava, C. (2026) THE IMPACT OF ARTIFICIAL INTELLIGENCE ON WOMEN ENTREPRENEURS LEADING SMES IN RURAL INDIA.
- Akhtar, M., Ghafoor, K. A., Maqsood, H., & Murtaza, K. (2026). FinTech payment services adoption among women: the impact of personality, financial services knowledge and artificial intelligence. *International Journal of Accounting & Information Management*, 34(1), 193-219.
- Patra, R., & Ali Abbas, S. (2026) Does digital technology adoption enhance women-ownership of MSMEs in India? Evidence from Karnataka
- Mumbai Suburban's historical count of women entrepreneurs from Maharashtra Sixth Economic Census. (https://mahades.maharashtra.gov.in/files/report/Sixtheconomic_census.pdf)
- MSME profile (<https://dashboard.msme.gov.in/>)
- ASUSE (Annual Survey of Unincorporated Sector Enterprises)
(https://www.mospi.gov.in/sites/default/files/press_release/Press_Note_ASUSE_202324_Report%20-English.pdf)
- RBI Annual Report on Digital-payment and financial-inclusion indicators
(<https://www.rbi.org.in/scripts/PublicationsView.aspx?id=22459>)