

The Synergy of Technology Adoption and Enterprise in Microfinance

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Abstract

Microfinance, aimed at alleviating poverty and promoting economic development among the unbanked and underprivileged population, has witnessed significant growth and evolution over the decades. While traditional microfinance institutions have made commendable progress in extending financial services to marginalized communities, the sustainability of the microfinance model remains a pressing concern. In this context, technology adoption and enterprise development play pivotal roles in ensuring the long-term viability and effectiveness of microfinance initiatives, presenting a transformative approach to foster enterprise development, and amplifying the potential of technology, resulting in alleviating poverty and economic empowerment.

Based on secondary data sources, this paper explores the interplay between technology adoption and enterprise development, emphasizing their collective importance in maintaining the sustainability of the microfinance model. Facilitating access to reasonable microloans, offering entrepreneurship training, establishing market linkages, and encouraging diversification of income sources are vital strategies to empower micro-entrepreneurs and alleviate poverty.

Keywords: Micro-credit, Financial Inclusion, Poverty, Technology, Enterprise Development

1. Backdrop:

The exorbitant cost of credit from traditional money lenders, coupled with insufficient support from institutional credit sources and the neglect of mainstream banking institutions towards individuals with low incomes, has paved the way for the emergence of microfinance. As a critical tool for financial inclusion, microfinance seeks to bridge the gap by providing essential

financial services to those deemed unfit by conventional banking networks (Tripathy, 2023). This becomes particularly crucial in delivering affordable banking and credit services to individual borrowers and the financially marginalized poor, employing the innovative mechanism of group lending, primarily facilitated by Self-Help Groups (SHGs) (Tripathy, 2015).

Microfinance has proven to be a powerful force in fostering entrepreneurship and alleviating poverty, especially in rural and remote areas (Tripathy, 2016). Through offering financial tools tailored to the unique needs of underserved communities, microfinance institutions empower individuals to engage in income-generating activities, breaking the cycle of poverty. The emphasis on group lending provides financial assistance and promotes a sense of community and mutual support, contributing to the overall economic development of these marginalized regions (Tripathy, 2017). It has been extensively explored in various studies, consistently revealing its remarkable ability to act as a countercyclical measure, effectively mitigating the adverse impacts of economic recessions, fluctuations, crises, and other adverse events at both micro and macroeconomic levels (Gatto, 2021, Tripathy 2015, 2016, 2017). It is a resilient and adaptable approach to meet financial vulnerability and instability in developed and developing economies.

Among the diverse instruments within the microfinance background, microcredit is a prominent and influential tool in research, policy development, and practical implementation. Microcredit's significance stems from its multifaceted role in combatting poverty and vulnerability while promoting entrepreneurial activities, a critical component, especially in regions burdened by economic depression. Empowering marginalized and at-risk demographic groups, focusing on women, forms a crucial dimension of microcredit's objective, enhancing their capabilities and socio-economic status (Gatto, 2020, Tripathy 2023).

The predominant goal of microcredit is to offer individuals trapped in the cycle of dire poverty the opportunity to break free from their predicament. Simultaneously, it contributes to sustainable, human-centric, and locally driven development initiatives, aligning with the principles of the capability approach (Gatto, 2020). This approach recognizes that poverty is

often a consequence of restricted access to resources rather than an inherent scarcity, especially in essential domains such as food, energy, water, and natural resources.

Empirical evidence further validates this perspective, demonstrating that famines and starvation are frequently the result of the poor's limited access to assets, including financial resources. This notion closely aligns with the capability approach's conclusions and interactions with sustainable and locally driven development, as evidenced in the works of Sen (1982) and Dreze and Sen (1989). In a world where access to financial tools is increasingly pivotal, recognizing it as a fundamental human right becomes imperative.

The evolution of microfinance, from its early roots to its current multifaceted form, is a testament to its potential to uplift the financially excluded. Its journey has demonstrated how resolving a broad spectrum of financial needs, promoting financial literacy, and adapting to local contexts can pave the way for social and economic transformation. Microfinance has extended its arms to the marginalized, bringing them under the umbrella of financial services, strengthening their economic well-being and fostering social progress and empowerment. The evolution of microfinance is a testament to its resilience, adaptability, and untiring commitment to fostering financial inclusion and reducing poverty worldwide.

ii. Objectives and methodology of the study:

- 1) To evaluate the impact of the evolution of microfinance services beyond credit, including savings, insurance, and remittances, on the financial inclusion of poor populations.
- 2) To analyze and compare the performance of different segments within the microfinance industry and the growth of Aspirational Districts from June 2022 to June 2023
- 3) To investigate how the adoption of technology, especially information and communication technology, and the interplay between technology adoption and enterprise development in microfinance have influenced the sustainability and efficiency of microfinance institutions.

Methodology:

This research adopts an empirical approach, utilising a mixed methodology, collecting data both from primary, secondary sources and observation techniques. Primary data collection

involves interviews, supplemented by case studies /success stories to draw inferences from the study.

The secondary data is sourced from Census Reports, Research Articles, Journals, Published books, various websites, and documents. It is supplemented by case studies /success stories and observation techniques to draw inferences from the study. Data sourced from the microfinance pulse report, vol XVIII – October 2, calculated year-on-year growth for the microfinance segment, analysed the performance trends and evaluated Aspirational Districts' metrics.

iii. Evolution Beyond Credit Services:

As the success of the Grameen Bank model became apparent, the microfinance sector began to expand and diversify its offerings. The initial focus on credit services broadened to include a more comprehensive array of financial products and services. This evolution aimed to address the diverse needs of the financially excluded and promote financial inclusion on a larger scale.

a. Savings Services: Recognizing the importance of savings as a cornerstone of financial stability, microfinance institutions started offering savings accounts to their clients. These accounts provided a secure place for clients to deposit their earnings and build a financial cushion for emergencies or investments.

b. Insurance Services: The microfinance sector realized that risk mitigation was critical for the financially vulnerable. In response, they began offering microinsurance products, protecting clients against unforeseen events like crop failure, illness, or natural disasters. Microinsurance helped clients safeguard their livelihoods from unpredictable setbacks.

c. Remittance Services: With the globalization of labour markets, remittances have become a significant source of income for many families in developing countries. Microfinance institutions recognized this and began providing remittance services, enabling clients to send and receive money securely and affordably.

iv. Diversification to meet financial needs:

The shift towards comprehensive financial services was instrumental in providing holistic solutions to the financially excluded. Microfinance institutions understood that individuals needed both credit and financial tools to build and manage their financial lives effectively. Mehrotra et al. (2009) present a multifaceted perspective on Inclusive Growth in the financial economy, distinguishing supply-side and demand-side drivers. Banks are expected to alleviate supply-side barriers, restricting disadvantaged and impoverished social groups from accessing the financial system. Financing first-time entrepreneurs, despite its associated risks, is indispensable for financial inclusion and growth. Moreover, demand-side factors, such as lower income and limited asset holdings, significantly impact financial inclusion. Given difficulties in accessing formal credit sources, individuals with modest means and small-to-medium enterprises often rely on personal savings or internal resources to invest in health, education, housing, and entrepreneurial ventures, capitalizing on growth opportunities.

a. Diversification to meet the broader financial needs: The Diversification of microfinance services addressed the broader financial needs of clients. By offering savings accounts, insurance, and remittances, these institutions became one-stop shops for various financial services. This convenience eliminated the need for clients to engage with multiple service providers, streamlining their financial transactions.

b. Customer-Centric Approaches: A fundamental aspect of this evolution was the shift towards customer-centric approaches. Microfinance institutions began to focus on understanding their clients' specific needs and preferences, tailoring their services to align with these requirements. This client-centric mindset fostered trust and loyalty.

c. Social and Economic Impact: Beyond merely addressing financial needs, microfinance's evolution has driven broader social and economic impacts. By providing women with access to financial services, microfinance has supported gender equality and women's empowerment, unlocking their potential as entrepreneurs and community leaders.

v. Diversity and Global Reach:

Microfinance is not a monolithic concept; it exhibits tremendous diversity in its models and approaches. Microfinance institutions have adapted to local contexts and needs, resulting in

various structures, from traditional non-governmental organizations (NGOs) to commercial banks and innovative fintech platforms.

a. Global Expansion: The impact of microfinance is not limited to Bangladesh or a few other nations; it has expanded globally. Countries across Asia, Africa, Latin America, and even parts of Europe and North America have witnessed the transformative potential of microfinance.

b. Variety of Models: Different regions and markets have created diverse microfinance models. For example, some organizations follow the group lending model, where individuals within a community guarantee each other's loans, fostering a sense of responsibility and mutual support. In contrast, others leverage technology to provide digital microfinance services that reach clients in remote areas.

Vi. Challenges to Microfinance Sustainability:

While the evolution of microfinance has been largely positive, challenges exist. Ensuring the sustainability of microfinance models, managing interest rates to remain affordable, avoiding over-indebtedness, and maintaining a client-centric focus are essential considerations for the sector's future.

Despite the undeniable benefits of microfinance in poverty alleviation and empowering marginalized communities, it faces several sustainability challenges. Key concerns include high operational costs, loan delinquencies, lack of diversified product offerings, and limited outreach. Moreover, traditional microfinance models often struggle to adapt to evolving financial landscapes, leaving them vulnerable to economic shocks and competition from fintech disruptors.

vii. Role of Technology Adoption in Microfinance:

Information and communication technology (ICT) has emerged as a game-changer for microfinance. The setting of personal financial services is undergoing a profound transformation, driven by the rapid evolution of internet technology. This dynamic shift redefines how financial services are conceived, developed, and provided to individuals. Adopting digital channels and mobile banking services has significantly reduced operational costs, improved outreach, and enhanced the efficiency of microfinance institutions (Anderson,

2018; Smith, 2020). As we venture further into the digital age, the fusion of cutting-edge internet technologies with financial services is ushering in a new era of innovation and accessibility, revolutionizing how we manage and interact with our finances.

The integration of digital solutions within microfinance institutions (MFIs) has garnered significant interest in recent years, influenced by theoretical frameworks emphasizing its impact on social performance, profitability, operational efficiency, and outreach. One prominent theory posits that digitalization enhances operational efficiency, reduces costs, and improves social performance by enabling MFIs to reach underserved populations more effectively. Studies show a positive correlation between digitalization, financial sustainability, and social impact within microfinance. Another perspective suggests that adopting information and communication technology (ICT) among MFIs leads to operational improvements and enhances their capacity for poverty alleviation and geographic outreach. ICT tools such as mobile banking, biometric authentication, and data analytics enable MFIs to overcome logistical challenges and extend services to previously inaccessible regions, expanding financial inclusion and reducing poverty. Despite the potential benefits, challenges exist in representing borrowers from developing countries and their access to digital microfinance platforms. Limited internet connectivity, language barriers, and digital literacy gaps hinder participation. Moreover, platform design may not align with cultural preferences. Resolving these challenges requires inclusive digital solutions catering to diverse populations (Yartey,2013).

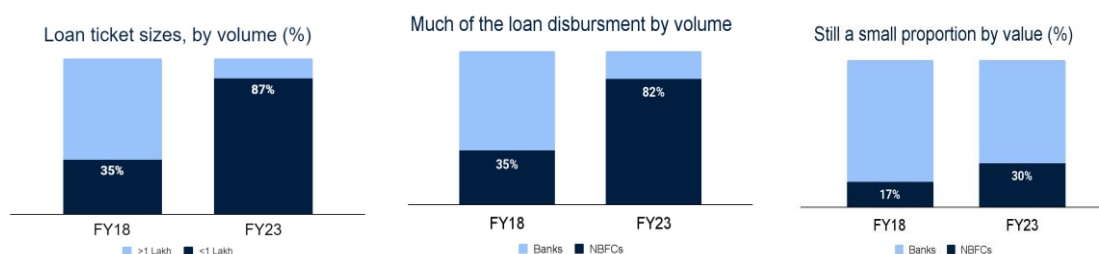
The integration of information and communication technology (ICT) within microfinance institutions (MFIs) has garnered significant attention due to its potential to enhance operational efficiency and expand outreach to underserved populations. This paper proposes a new theoretical framework highlighting the transformative impact of ICT adoption on MFI outreach capabilities, particularly in addressing poverty and geographic constraints. The theory suggests that ICT adoption leads to operational improvements, enabling MFIs to reach remote or marginalized communities through tools like mobile banking and data analytics. Empirical evidence supports this theory, indicating a positive correlation between ICT adoption and MFI outreach effectiveness. Embracing digital solutions can enhance financial inclusion and contribute to sustainable development goals (Weber, 2012). Mobile money

platforms and digital payment systems have facilitated the disbursement and repayment of loans, reducing the need for physical infrastructure and in-person interactions. Furthermore, data analytics and artificial intelligence have enabled better risk assessment and targeted customer engagement (Brown & Jones, 2019; Garcia & Martinez, 2021).

There are various Inclusive Financial Institutions in India, including Regional Rural Banks, United Community Banks, Local Area Banks, and Non-Banking Financial Companies Micro-Finance Institutions (NBFC-MFIs). These institutions are vital in extending financial services to diverse population segments.

NBFCs, including FinTechs, dominate small personal loans, dispersing 82%. However, regarding value, they only account for about 30% of all personal loans, indicating their focus on smaller amounts.

Small ticket loans account for nearly 9/10ths of loans by volume	NBFCs account for four out of five personal loans disbursed in FY23	Less than 1/3 by value and hence are mostly driving small ticket personal loans.
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Source: Centre for Research in International Finance (CRIF), Digital Lenders Association of India (DLAI)

Moreover, the Aadhaar biometric ID program, linked to access to micro-accounts, is a crucial identification-related measure that facilitates financial inclusion by providing individuals with a unique and secure identity. Furthermore, financial technology, or Fintech, has garnered substantial attention in India due to its perceived potential. Fintech is regarded as a catalyst for financial inclusion, driven by its capacity to deliver innovative services online, mainly through ubiquitous smartphones.

When examining the major categories of financial services offered by Fintech firms in India, they encompass a wide range of services, including Payments and Transfers (comprising E-Commerce Payments, Mobile Banking, Mobile Wallets, P2P Payments and Transfers, Digital Currency, and Cross-Border Transactions, including Remittances and B2B Payments). Personal Finance services are also prominent, encompassing the likes of Robo-Advisors, Mobile Trading, and Personal Financial Management tools (Tripathy, 2019).

Furthermore, Fintech firms actively provide Alternative Financing solutions, such as Crowdfunding, P2P Lending, Invoice Financing, and supply chain Finance, offering various options for individuals and businesses seeking non-traditional financial support. Finally, Fintech ventures are venturing into various other domains, including insurance-related services, thus showcasing their versatility in catering to diverse financial needs in the Indian market.

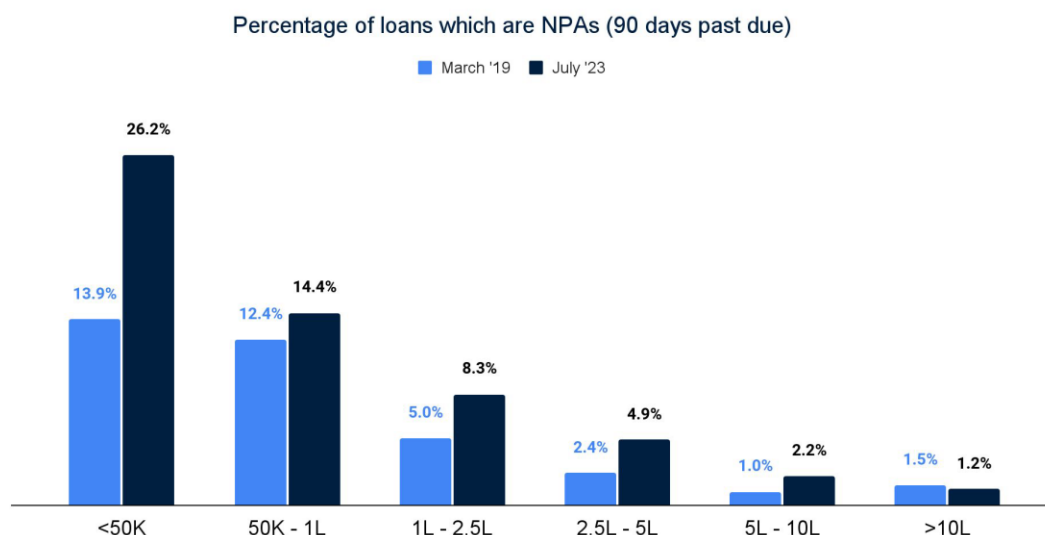
The landscape of consumer lending experienced a notable resurgence following the tumult of the COVID-19 pandemic. From March 2020 to September 2023, the portfolio size expanded by an impressive 64%, accompanied by a significant improvement in Portfolio at Risk (PAR) 31-180, dropping from 4.7% to 3.5%—marking a 25% improvement over the same period.

This resurgence was driven by various products, with short-term personal loans (STPL) leading the charge with a staggering 204% growth, followed closely by gold loans (121%), personal loans (115%), and credit cards (76%). However, there was a slight uptick in PAR 31-180% for housing loans and credit cards from March 2023 to September 2023.

Geographically, urbanized, and industrialized states such as Maharashtra, Tamil Nadu, and Karnataka emerged as top performers in consumer lending, with notable exceptions like Uttar Pradesh and Rajasthan. In personal loans specifically, Maharashtra, Tamil Nadu, and Karnataka showcased robust growth despite already having a higher base.

Reducing the percentage of households below the poverty line and the unbanked population indicates the broader economic impact and progress in financial inclusion facilitated by the

synergy between technology adoption and enterprise development in microfinance.



Approximately 25% of loans under ₹50k are NPAs (90+ days overdue). The surge in personal credit, especially to high-risk customers, drives up NPAs. Smaller loans correlate with higher default rates.

Table 1: Microfinance Industry Overview (Portfolio Outstanding (` crore)

Particulars	Jun' 22	Sep' 22	Dec' 22	Mar' 23	Jun' 23	Y-o-Y growth%
Banks	98,445	98,001	95,923	104,984	102004	4%
SFBs	44,810	45,046	46,878	52,386	56296	26%
NBFC-MFIs	95,671	102,129	114,776	129,414	140,026	46%
NBFCs	25,232	23,175	26,506	28,850	31,278	24%
Not for Profit MFIs	2,383	2,999	3,154	3,446	657	-72%
Total Industry	266,541	271,350	287,237	319,080	330,261	24%
Q-o-Q growth rate %	-	2%	6%	11%	4%	-

Source: Microfinance pulse report, vol XVIII – October 2023, P.7

Table 1 depicts that despite fluctuations, banks and NBFCs have shown overall growth throughout the period. Banks witnessed a mild year-on-year growth of 4%, while NBFCs observed a 24% growth from June 2022 to June 2023.

Small Finance Banks (SFBs) and NBFC-MFIs have demonstrated substantial growth rates. SFBs experienced a remarkable year-on-year growth of 26%, while NBFC-MFIs saw an even

higher growth rate of 46% during the same period. Not-for-profit MFIs experienced significant fluctuations, ending with a negative year-on-year growth of -72%. This erratic performance may require further investigation into the factors contributing to such fluctuations.

The microfinance industry witnessed a steady growth of 24% from June 2022 to June 2023. This growth indicates a positive industry trend despite variations in individual segments. While there have been fluctuations in quarter-on-quarter growth rates, there is an overall positive trend. The industry experienced a significant 11% quarter-on-quarter growth rate from March 2023 to June 2023, indicating a solid performance. The microfinance industry demonstrates resilience and growth across segments, with SFBs and NBFC-MFIs leading, yet not-for-profit MFIs struggle, requiring attention due to significant negative growth.

Table 2: Aspirational Districts – June 2023 Overview

Aspirational Districts Growth Particulars	30th June 2022	30th June 2023	Growth %
Active Borrower Penetration ('000)	9,867	12,229	24%
Disbursement Amount (₹ in crore)	*41,025	**48,396	18%
Active Loans ('000)	15,031	17,102	14%
Portfolio Outstanding (₹ in crore)	37,123	45,145	22%
***30+ Delinquency	3.98%	1.69%	-
***90+ Delinquency	1.48%	0.82%	-

Disclaimer: *Disbursement July 2021 to June 2022. **Disbursement July 2022 to June 2023.

*Delinquencies are calculated basis POS.

Table 2 provides data on the growth of Aspirational Districts¹ from June 30, 2022, to June 30, 2023. The number of active borrowers in Aspirational Districts has grown significantly, 24%,

from 9,867,000 in June 2022 to 12,229,000 in June 2023. This indicates an increasing outreach and accessibility of financial services in these districts.

There has been an 18% increase in the disbursement amount from Rs. 41,025 crores in June 2022 to Rs. 48,396 crores in June 2023. This suggests an enhanced flow of credit to individuals and businesses within the Aspirational Districts, potentially driving economic activities and growth.

Active loans have grown by 14%, from 15,031,000 in June 2022 to 17,102,000 in June 2023. This indicates a higher demand for loans within these districts for various purposes such as entrepreneurship, education, or housing.

The portfolio outstanding has increased by 22%, from Rs. 37,123 crores in June 2022 to Rs. 45,145 crores in June 2023. This demonstrates a substantial growth in the overall value of loans extended and reflects the increasing confidence of financial institutions in these districts. The 30+ and 90+ delinquency rates have decreased significantly, with the 30+ delinquency dropping from 3.98% to 1.69% and the 90+ delinquency reducing from 1.48% to 0.82%. This indicates improved loan repayment behaviour and better credit quality within the Aspirational Districts. The data indicates significant progress in financial inclusion and credit access within the Aspirational Districts, marked by rising borrower penetration, increased disbursements, diversified loan portfolios, and enhanced delinquency rates.

Mobile Money Transfer (MMT) has marked a new frontier in mobile phone technology, with an ever-increasing number of micro-businesses using it in their transactions to enhance performance (Masila, 2015). The number of uses to which Mobile Money Transfer (MMT) can be put keeps increasing with time. However, it is unclear how Mobile Money Transfer use influences the growth of SMEs. The study established that mobile money had significantly contributed to the SME sector.

Mobile money services have revolutionized money transfers, enhancing speed and safety. This shift energizes rural economies by facilitating swift money circulation and boosting local consumption. Reduced costs, improved efficiency, and reliability enable more transfers to rural areas, amplifying economic activity in underserved regions.

Mobile payment tech, exemplified by M-Pesa, offers unparalleled convenience and security. Access to accounts relies on PINs, mitigating risks of loss or theft. In underbanked regions, it

is transformative, enabling easy transactions and cash withdrawals. Users demand speedy, secure transactions safeguarded by PINs and encryption. M-Pesa empowers small businesses, reducing reliance on banks, thus streamlining operations, and boosting productivity.

Table 3: Effectiveness of Mobile Banking in Expanding Outreach:

Metric	2019	2021
Active Mobile Money Accounts (millions)	1,067	1,340
Mobile Money Transactions (billions)	37.8	49.4

Source: GSMA Mobile Money Report 2021

Table 3 reveals that, in the year 2020, there was a significant increase in the usage of smartphones, with the percentage of people using these devices rising from 35% to 80%. Furthermore, on a global scale, it is noteworthy that approximately 6.8 billion individuals have access to mobile phones, and nearly all these devices are fully activated with internet capabilities (Sanakulov & Karjaluoto, 2015). Consequently, this surge in smartphone usage has had a profound impact on the banking industry, particularly in expanding access to banking services and shaping public perception of banks. As a result, mobile banking has emerged as a powerful tool for reinforcing the overall rates of bank accessibility (Shareef & Baabdullah, 2018)

Banking sees a significant shift as customers increasingly rely on smartphones and tablets for various tasks, from shopping to employment-related activities. Institutions favour tech-savvy clients, acknowledging the prevalence of mobile-centric lifestyles and emphasizing the importance of adeptness with mobile technologies in engaging with modern banking services. Mobile money has empowered over a billion people, promoting financial inclusion and economic growth. Its recent substantial growth reflects the rising acceptance and impact of digital financial services, reaching unbanked populations and promoting economic inclusion. Brandon Tan (2023) aptly examines the impact of financial inclusion and the implications of introducing a retail central bank digital currency (CBDC) in developing countries which have the potential to bank large unbanked populations and boost financial inclusion, which can increase overall lending and reduce bank disintermediation risks.

a. Reduced Operational Costs: Traditional microfinance institutions often need help with high operational costs associated with maintaining physical branches, paper-based record-keeping,

and manual loan processing. With the adoption of digital technology, microfinance institutions can streamline their operations and reduce these costs significantly. Digital platforms allow for automated processes, reducing the need for physical infrastructure and administrative staff. This translates into cost savings that can be passed on to borrowers through lower interest rates or used to expand outreach.

Current challenges on the supply side encompass products that are not tailored to the informal sector, inflexible and document-intensive processes, technology availability and acceptance, and outreach limitations by available financial institutions. Although various strategies address the "last mile" delivery of financial services, such as kiosks and rural ATMs, most prevailing financial inclusion delivery models converge on handheld devices equipped with wireless connectivity, biometric authentication, and micro-printers. Transaction costs represent a critical aspect of mobile payments technology adoption, given their inherent affordability compared to traditional banking and money transfer mechanisms (Omwansa, 2009). The cost of payment transactions significantly affects consumer adoption when these costs are transferred to the customers (Mallat, 2007). Low transaction costs are crucial for maintaining overall competitiveness in payment processing, ensuring that mobile payments remain an accessible option for micro-business operators. These costs must be considerably lower than traditional bank transaction fees, aligning with the financial capacities of most micro-business operators. Furthermore, the market offers a plethora of user-friendly mobile handsets equipped with the necessary features for engaging with mobile payment technology.

b. Improved Outreach: Technology, particularly mobile phones, has proven to be a powerful tool for expanding the outreach of microfinance institutions. Mobile banking services enable financial inclusion in remote and underserved areas where traditional brick-and-mortar branches are often unfeasible. This directly impacts the sustainability of microfinance institutions, as a more extensive customer base can lead to increased revenue and reduced risk due to Diversification. The Theory of Technology Acceptance Model (TAM), a widely recognized framework in technology adoption and use, seeks to understand how individuals embrace and employ new technologies. Mobile payment procedures, a quintessential example of information technology (IT) applications in finance, can be appropriately used to accelerate the pace of financial inclusion in India, enhancing operational efficiency (Tripathy, 2019).

This model proposes that when individuals encounter a novel technology, multiple determinants come into play, shaping their decisions on when and how to embrace and employ it. The pivotal factors within TAM are perceived usefulness, denoting the extent to which an individual believes that adopting a specific system would enhance their work performance, and perceived ease of use, reflecting the extent to which one believes that utilizing the system would entail minimal effort (Davis, 1989).

c. **Enhanced Efficiency:** Digital channels reduce costs and enhance the efficiency of microfinance operations. The disbursement and repayment of loans can be executed quickly and securely through mobile money platforms. Borrowers can easily access funds and make payments, reducing the friction and time involved in traditional lending. This enhanced efficiency is crucial in retaining customer trust and satisfaction.

d. **Risk Assessment and Customer Engagement:** Data analytics and artificial intelligence (AI) are pivotal in risk assessment and customer engagement. Microfinance institutions can make more informed lending decisions by analyzing a borrower's digital footprint, including transaction history, behaviour, and other relevant data. This not only minimizes the risk of loan defaults but also enables institutions to tailor their services to meet the specific needs of borrowers. Targeted customer engagement, based on data insights, can result in a more personalized and customer-centric approach to microfinance.

e. **Digital Identity and Credit Scoring:** Technology has also facilitated the development of digital identity systems and credit scoring mechanisms. These innovations make it easier to assess borrowers' creditworthiness, even without a traditional credit history. This is particularly important in regions with limited formal credit history data access. Digital identity and credit scoring systems enable microfinance institutions to make more accurate lending decisions and offer loans to individuals who would otherwise be excluded from the financial system.

f. **Customer Convenience and Financial Literacy:** Technology adoption in microfinance extends beyond lending and payments. It also encompasses financial literacy and education initiatives. Mobile apps and online resources provide borrowers with information and tools to improve their financial literacy and money management skills. This, in turn, empowers borrowers to make informed financial decisions and manage their loans more effectively.

viii. AI and Microfinance:

Microfinance, microcredit, and microlending have become potent tools for empowering individuals, especially from marginalized communities worldwide, to pursue entrepreneurial ventures. Artificial Intelligence (AI) integration has revolutionized this sector, addressing challenges such as scarce customer data and creditworthiness assessment.

AI systems efficiently collect and analyze vast amounts of data, enabling microfinance institutions to reach a broader customer base and make informed decisions about loan disbursements—predictive analytics aids in strategic decision-making, especially in sectors like agriculture, by forecasting future trends.

Assessing creditworthiness is streamlined through AI's analysis of various factors, including geographic location, purchase history, and social media behaviour. This holistic approach enables sound lending decisions for those lacking traditional credit histories, unlocking financial opportunities.

AI-based chat software enhances customer service, operating round the clock to address inquiries and reduce operational costs. Cashpor's use of the 'KiScore' tool exemplifies AI's impact, facilitating real-time loan decisions based on credit behaviour analysis.

Microfinance AI systems like Microfinance.ai offer enhanced customer insights, streamline processes, and provide multi-language support, overcoming barriers to accessibility. These platforms empower individuals to access loans for entrepreneurship, marking a profound shift in microfinance's landscape with promising prospects.

ix. Microfinance and Machine Learning (ML):

In microfinance, Machine Learning (ML) revolutionizes the assessment process for rural and poor individuals seeking microcredits. Traditionally, business rural advisors manage the high-risk index associated with these evaluations. This research introduces a model that enhances accuracy in microcredit assessments by employing determination analysis of rural variables drawn from specialized literature. Serving as a decision-support tool for rural advisors, the model aims to mitigate credit risks for rural microfinance institutions. It meticulously evaluates key financial and microfinance variables after thorough data pre-processing. ML

models are then meticulously chosen, trained, and validated, employing various metrics for evaluation. This innovative approach optimizes decision-making by leveraging ML's predictive capabilities, empowering business rural advisors to make more informed assessments and ultimately reducing credit risks for microfinance institutions serving vulnerable populations.

x. Enterprise Development and Diversification:

Sustainability in microfinance hinges on promoting enterprise development among borrowers through financial literacy, entrepreneurship training, and market linkages. Microfinance institutions uniquely empower micro-entrepreneurs by providing access to micro-loans and imparting essential financial and business management skills. This empowerment leads to increased income-generating opportunities and economic growth within communities.

Financial literacy programs offered by microfinance institutions bridge the knowledge gap among clients, enabling them to manage funds effectively and make informed financial decisions. These programs teach budgeting, saving, investment, and responsible borrowing, fostering inclusive economic growth alongside financial inclusion efforts.

Facilitating market linkages is vital for micro-entrepreneurs to access customers, retailers, or distributors. Microfinance institutions are crucial in connecting borrowers to potential markets, expanding their reach, and boosting sales, particularly in agriculture, handicrafts, and small-scale manufacturing.

Encouraging income diversification reduces clients' vulnerability to economic shocks. Microfinance institutions promote activities beyond the primary income source, such as poultry farming or handicrafts, enhancing financial stability and resilience.

Enterprise development through microfinance contributes to broader social development by reducing poverty, improving living standards, and empowering communities. Entrepreneurs, especially women, become agents of positive change and empowerment, driving social and economic progress.

Diversification of financial products complements enterprise development by addressing clients' broader financial needs. Savings accounts encourage clients to build financial security, which is particularly beneficial for those with irregular incomes. Microinsurance products

protect against various risks, preventing clients from falling into cycles of debt due to unexpected events. Remittance services enable secure and affordable money transfers, supporting clients with family members working in distant locations.

The symbiotic relationship between enterprise development and diversification creates a holistic approach to microfinance. By empowering individuals and addressing their financial needs comprehensively, microfinance institutions contribute to communities' economic and social development.

As microfinance institutions evolve and adapt to their client's changing needs, they must recognize the importance of fostering entrepreneurship and providing a wide array of financial services. This dual approach secures the sustainability of microfinance models and serves as a potent tool for poverty alleviation and inclusive economic growth.

xi. Synergy Between Technology and Enterprise Development:

The integration of technology and enterprise development in microfinance is not mutually exclusive but rather mutually reinforcing. Through its efficient and cost-effective financial services, technology provides the foundation for enterprise development. In contrast, enterprise development, in turn, amplifies the potential of technology to create a self-reinforcing cycle of economic empowerment and financial inclusion. This synergy forms a critical paradigm that sustains microfinance initiatives and propels them to achieve meaningful and transformative impacts on the lives of unbanked and underprivileged populations, creating a self-reinforcing economic empowerment and financial inclusion cycle. Empowering micro-entrepreneurs with digital skills and financial literacy allows them to leverage technology to optimize their businesses.

Technology enables data collection and analysis, which can inform better risk assessment and lending decisions, ultimately supporting the growth and stability of micro-enterprises. Empowering micro-entrepreneurs with digital skills and financial literacy allows them to harness technology for business optimization. This increases the effectiveness and impact of technology adoption. Enterprise development encourages the Diversification of income streams. With multiple income sources, micro-entrepreneurs have more reasons to adopt technology to manage and optimize their various businesses. Enterprise development fosters

a customer-centric approach, ensuring that technology solutions align with the specific needs and preferences of micro-entrepreneurs. This encourages greater technology adoption and usage. To illustrate the impact of this synergy, we examine statistical data from microfinance institutions and the broader economic context.

Table: 4 Microfinance: Enhancing Efficiency, Impact on Financial Inclusion

Metric	2014	2019	2021
Cost of Borrowing (%)	-	23.63%	21.95%
Operational Expense Ratio (%)	-	8.27%	7.92%
Percentage of Households Below Poverty Line ¹	24.85%	-	15%
Percentage of Unbanked Population	55%	-	22%

Sources: MIX Market, the World Bank; NITI Aayog; Global Findex Database 2021; Inter Media India FII Tracker survey: Wave 2 (N=45,087 15+) September-December 2014.

Note: National Multidimensional Poverty Index (MPI) representing India's progress in reducing multidimensional poverty between the two surveys, NFHS-4 (2015-16) and NFHS-5 (2019-21)

Table 4 indicates a notable improvement in microfinance efficiency and financial inclusion metrics over time. Between 2019 and 2021, the cost of borrowing and operational expense ratio decreased, signaling enhanced efficiency attributed to technology adoption. This decrease translates to more affordable financial services for micro-entrepreneurs, potentially reducing their financial burden.

Moreover, the economic impact and financial inclusion metrics portray significant progress. The percentage of households below the poverty line decreased from 52% in 2014 to 15% in 2021, while the percentage of the unbanked population dropped from 55% to 22%. This indicates substantial strides in alleviating poverty and expanding access to financial services, likely driven by the efforts of inclusive financial institutions in India.

xii. Case Studies and Success Stories

Let us present case studies and success stories from various microfinance institutions worldwide, showcasing how technology adoption and enterprise development have contributed to their sustainability.

a. Grameen Bank - Bangladesh:

Grameen Bank in Bangladesh, founded by Nobel Laureate Muhammad Yunus, is a pioneering example of successful microfinance. They embraced technology by integrating mobile banking solutions into their operations. This innovation allowed borrowers in remote areas to receive and repay loans conveniently using mobile phones, reducing the need for physical infrastructure.

Concurrently, Grameen Bank invested in enterprise development. They provided tailored training to borrowers, nurturing their entrepreneurial skills. This holistic approach significantly increased repayment rates and empowered borrowers to scale their businesses. Grameen Bank is a prime example of how combining technology and enterprise development can drive the sustainability of a microfinance institution.

However, the 'Grameen' model of microfinance, while celebrated for empowering the impoverished, faces criticisms including high interest rates, dependency on loans, limited impact on poverty alleviation, and challenges in sustainability and scalability.

b. Banco Compartamos - Mexico:

Banco Compartamos, a microfinance institution in Mexico, has harnessed the power of technology to expand outreach and efficiency. They introduced a sophisticated credit scoring system that utilizes big data analytics to assess borrower creditworthiness. This technology has allowed them to serve more clients and minimize loan defaults.

Simultaneously, Banco Compartamos has been proactive in fostering enterprise development. They offer comprehensive training programs in financial literacy and business management. This dual strategy has resulted in lower operational costs and higher repayment rates, reinforcing their long-term sustainability.

c. BRAC - Bangladesh:

Initially founded in 1972 as the Bangladesh Rehabilitation Assistance Committee and later known as the Bangladesh Rural Advancement Committee (BRAC), one of the world's largest non-governmental development organizations runs a microfinance program in Bangladesh.

They integrated technology by creating a mobile banking platform known as bKash. This platform enables borrowers to receive and repay loans and securely transfer funds via mobile phones.

In terms of enterprise development, BRAC has implemented a multifaceted approach. They not only provide financial training but also focus on diversifying the skills of their clients. BRAC has empowered borrowers to venture into various income-generating activities by introducing vocational training programs. This combination of technology and skill diversification has significantly contributed to their sustainability.

d. SKS Microfinance - India:

Swayam Krishi Sangham Microfinance (SKS) in India has capitalized on technology by digitizing its loan processes and leveraging data analytics. This has allowed them to streamline operations and reduce costs while serving more clients in rural areas. They also adopted mobile banking, making it easier for clients to access financial services.

In parallel, SKS Microfinance places a strong emphasis on enterprise development. They provide training in financial literacy and offer market linkages, helping clients establish successful businesses. SKS Microfinance has witnessed higher repayment rates and sustainable growth by fostering entrepreneurship.

e. ASA - Bangladesh:

The Association for Social Advancement (ASA) is a non-governmental organization based in Bangladesh, a leading microfinance institution that has made remarkable strides by embracing technology. They introduced a biometric identification system, which not only streamlined the disbursement process but also ensured the security of transactions. Moreover, they have a robust IT infrastructure that supports online loan applications and approvals.

Regarding enterprise development, ASA is renowned for its vocational training programs. They offer skill development and job placement services, empowering clients to secure alternative income sources. This approach has been instrumental in sustaining their microfinance operations.

f. Tala - Global: Tala is the leading financial platform for the global majority. Tala, a global fintech company, represents a unique approach to microfinance. They operate through a smartphone app that utilizes alternative data sources to assess the creditworthiness of unbanked individuals in emerging markets. Tala's use of technology has enabled them to serve clients who were previously excluded from the formal financial sector. Tala also places a strong emphasis on customer education and enterprise development. They provide in-app financial literacy content and tools to help clients manage their finances effectively. This proactive approach has contributed to their rapid growth and the sustainability of their digital microfinance model.

These case studies illustrate microfinance institutions' diverse approaches to leverage technology adoption and enterprise development for sustainability. They showcase how innovative use of technology, combined with tailored training and skill development, has led to higher repayment rates, increased outreach, and the empowerment of clients to build sustainable businesses.

xiii. Conclusion:

The synergy between technology adoption and enterprise development in microfinance isn't just theoretical; it's supported by data and real-world success stories. This synergy significantly impacts economic empowerment, poverty reduction, and financial inclusion. Integrating technology and enterprise development creates a self-reinforcing cycle sustaining efforts and driving transformative change for the unbanked and underprivileged.

Despite varying strategies and technologies, microfinance institutions share a commitment to financial inclusion, entrepreneurship, and technology adoption, showcasing the common thread in their success globally. These success stories inspire other institutions striving for sustainability and meaningful impact.

Mobile money, particularly mobile banking, offers transparent services, enhancing operational efficiency for SMEs and ensuring transaction reliability. This synergy between technology and enterprise development yields tangible benefits, including increased mobile banking adoption, improved loan repayment rates, and enhanced income diversification.

In the dynamic microfinance landscape, sustainability is crucial for long-term developmental goals. Technology adoption and enterprise development offer a potent solution, reducing operational costs, expanding outreach, and fostering holistic micro-entrepreneur development.

xiv. Policy implications:

To enhance the growth of Microfinance Institutions (MFIs), the government could establish a guarantee fund with Nabsanrakshan, a NABARD subsidiary. This fund would provide coverage for MFIs borrowing from banks while allocating an initial ₹500 crore. Collaborative efforts with Cooperative Banks (CBs) to moderate interest rates are recommended, leveraging the solid financial performance of banks and NBFCs.

Moreover, upgrading certain NGOs into MFIs through capital infusion, capacity building, and management strengthening can empower them as financial intermediaries in underserved areas, promoting financial inclusion. This underlines the importance of comprehensive market research and client surveys to understand the financial needs of the target population and prioritize the development of diverse financial products and services, including savings accounts, insurance, and remittance services. Partnerships with local communities, NGOs, and government agencies are essential for outreach and education on financial inclusion, alongside implementing financial literacy programs. Adopting a customer-centric approach, gathering feedback, customizing services, and providing exceptional support and education are crucial for client satisfaction and trust.

Moreover, facilitating access to reasonable microloans, offering entrepreneurship training, establishing market linkages, and encouraging diversification of income sources are vital strategies to empower micro-entrepreneurs and alleviate poverty.

Funding Acknowledgment:

This research received no specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of Interest Statement:

The author declares that no conflict of interest is associated with this research.

Notes:

¹Aspirational Districts (AD) - Districts (currently 117 in no.) identified by NITI Aayog, GoI, in January 2018, for improvement to enhance Human Development Index, in turn, based on composite indicators like Health & Nutrition, Education, Agriculture & Water Resources, Financial Inclusion, Skill Development and Basic Infrastructure

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