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The role of financial technology and financial literacy in driving financial inclusion among the women workforce in the informal sector

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ABSTRACT

BACKGROUND AND OBJECTIVES: Financial Inclusion is directly related to economic growth and is an integral factor in achieving sustainable development goals. As India plans to achieve Viksit Bharat by 2047, which calls for inclusive growth, the role of women and their participation in the economy becomes a significant factor in its achievement. Women have long been suppressed by patriarchal norms in a country like India, which prohibits them from availing formal financial services. However, with the development of financial technology, the gap between underserved populations and formal financial services can be reduced if used effectively. This study attempts to unravel the importance of urban financial advancements in driving financial inclusion of women's workforce in the informal sector.

METHODS: This study adopted a confirmatory quantitative survey method using Structural Equation Modeling to explore the mediating role of financial literacy between fintech and financial inclusion among women in Chennai's informal sector. Data were collected over eight weeks through snowball sampling, using both online and in-person surveys administered in Tamil. A structured questionnaire with a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree) was used. Responses were coded by researchers, data consistency verified with an independent sample t-test, and analyses conducted using the Statistical Package for Social Sciences and Analysis of Moment Structures.

FINDINGS: The findings of the study indicate that financial technology and Financial Literacy have a significant positive impact on Financial Inclusion. The study also finds that Financial Literacy mediates the impact of financial technology on Financial Inclusion. Partial mediation exists in the relationship between financial technology, Financial Inclusion, and Financial Literacy, and the impact of financial technology on Financial Literacy is strengthened with a beta estimate of 0.481 after Financial Literacy is introduced as a mediating variable as compared to 0.347 before mediation. This suggests that financial technology can provide access to financial services, but utilization of these services effectively depends on Financial Literacy.

CONCLUSION: This study highlights the complementary roles of financial technology and literacy in advancing inclusion among women in India's informal sector. While fintech improves access to services, its impact is greater when users have financial knowledge and skills. The findings emphasize the need for integrated policies combining digital tools with financial education, supporting India's inclusive growth goals under Viksit Bharat 2047. These insights are valuable for policymakers, regulators, fintech providers, and agencies working to close gender and financial gaps.

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
59	3	2

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INTRODUCTION

Financial Inclusion (FI) is a significant tool for achieving 7 out of the 13 Sustainable Development Goals (SDGs) as per the World Bank. Success requires those who are unbanked and financially excluded to start using the formal banking system and its products and services (Barik and Sharma, 2019). Empowering women promotes gender equality, which is one of the major aims of the SDGs (Barik and Lenka, 2021). According to Sarma and Pais (2008), FI is the process of making sure that all underprivileged and marginalized people have a way to get access to inexpensive financing. The FI committee of the Reserve Bank of India (RBI) defines FI as *"access to the formal financial sector for marginalized and finance-deprived sections of society"*. Despite the efforts of the RBI, a large sector of people remains disconnected from the official financial system (Mahadeva, 2008). Unbanked individuals comprise a large segment of the global population, disproportionately impacting women and young people (UNDESA, 2021). In 2022, 1.4 billion people globally didn't have a basic bank account, which has been significantly reduced from 2.5 billion individuals in 2011. Though this might seem like a huge improvement, it has been found that most of the banked population is living in developed countries, while the majority of the unbanked population continues to live in developing countries. While 94% of the population in developed countries is banked, over 63% of the population in developing countries is unbanked. Financially excluded sections of society include farmers, unorganized workers, women, craftsmen, the self-employed, and convicts (Dev, 2006). The gender divide in FI is still a significant issue in developing countries, where more than 50% of women from poor households and the informal sector are still unbanked. In a country like India, which is rapidly approaching the status of one of the world's greatest economies, women FI play a significant role. The Indian government has established a blueprint to become a developed and empowered economy by 2047, known as 'Viksit Bharat 2047', coinciding with India's 100th anniversary of independence. One of the three pillars of 'Viksit Bharat' is women's empowerment, and a developed economy by 2047 requires inclusive development without gender parity. According to the NITI Aayog's (2022) report, the long-term development of the country depends on women's participation in the economy, their

growth, and poverty reduction. In 2016, India planned to increase its Gross Domestic Product (GDP) by 0.7 trillion US dollars by bringing an additional 68 million people into the workforce. But despite this, Indian women's contribution to GDP accounts for only 17%, less than half the global average. The informal sector employs around 82% of all working women in India, accounting for 95% of women in South Asia. These women labour as street vendors, minor product and service sellers, subsistence farmers, seasonal workers, domestic helpers, and factory workers. Economic participation and contribution by women can only be achieved by the FI of these women. Most Indian women from a rural background don't hold a bank account, and even if they do, it's either dormant or operated by the men in the family. In a country like India, where men hold the upper hand in decision-making and finances of the family, it is a challenge to bring women into availing and using financial services effectively. The introduction of digital financial services through financial technology (Fintech) has enabled people, including women, to avail of financial services more effectively and easily. Among the developing countries, India is one of the countries to leverage Fintech for FI. Because of Fintech, over 80% of the people in India are banked now, and it is in the process of moving from 'having a bank account' to 'using the bank account effectively'. Fintech has been proven to increase financial awareness among women and also empower them in financial decision-making skills (Sidana *et al.,* 2023). This study examines the influence of Fintech in promoting women's FI in India's informal sector. Fintech, short for Fintech, refers to a wide spectrum of technological innovations in financial businesses like cryptocurrencies, blockchain, electronic payments, electronic transfers, virtual trading, etc., that improve or change the delivery of financial services (Philippon, 2019). Mobile connectivity has been rather more accessible and reasonably priced during the last two decades. In this context, fintech, technological advancements in the financial sector, has opened up numerous opportunities. Fintech startups typically target sectors where traditional financial institutions do not have a presence or perform poorly. In the current digitally advanced environment, fintech has the capability and capacity to democratize financial systems, remove information gaps, and digitize financial services, all the while boosting speed,

efficiency, and cost-effectiveness. Thereby, digital financial services could be a great way to encourage economic growth by increasing market participation and FI. Providing access to basic financial tools it could drastically help poor people, particularly women, boost their income, improve their living conditions, and build resilience. The novelty of this research lies in its comprehensive exploration of the role of fintech and Financial Literacy (FL) in driving FI among women in the informal sector. Unlike traditional approaches that emphasize supply-side parameters (Sarma, 2008), this study shifts the focus to demand-side factors, analyzing how women actively use financial services for saving and transactions. It highlights the critical influence of FL as a driver of FI, examining its interplay with fintech to create meaningful access and utilization of financial resources. Many studies in the literature have focused on the supply-side parameters of FI (Yadav and Reddy, 2023; Singh et al., 2022), but there is a lack of research that analyzes the demand-side parameters (Nandru and Rentala, 2020). Furthermore, primary data is scarcely used to analyze FI (Bhatia and Singh, 2019). FI is no longer just about owning a bank account, but about actively using it for saving and transacting (Barik and Sharma, 2019). Therefore, it is essential to measure FI using demand-side parameters and to explore the factors driving it. This study represents one of the foremost efforts to analyze the role of fintech in driving FI through primary data, capturing demand-side factors. FL is another major factor that has been highlighted in the literature. Numerous studies analyze the importance of FL (Togun et al., 2022; Cole et al., 2011; Huston, 2010), yet combined research on both FL and FI constitutes only about 11% of the total literature (Khan et al., 2023). This research is among the first to analyze the connection between FL, fintech, and FI specifically among women in the informal sector in India. Additionally, there is a lack of in-depth and exhaustive measures in the literature to understand the factors that effectively impact and determine the FI of women in India's unorganized sector (Singh et al., 2022. This study aims to set the first precedent to measure the determinants of FI for women in Southern India and to capture the role of fintech and FL in contributing to it. This research also pioneers an in-depth analysis of the determinants of FI specifically for women in the unorganized sector, setting a precedent for understanding and enhancing

their economic participation in Southern India. This study attempts to unravel the significance of financial advancements and FL in driving the FI of women in India. The two main purposes of this study are

(i) *To assess the impact of fintech and FL on the FI of women in the informal sector; and*

(ii) *To determine the role played by fintech and FL combined in driving the FI of women.*

Furthermore, the significance of this research stems from three perspectives:

(i) *The role of fintech in increasing FI among women while lessening gender inequality can be established.*

(ii) *The determinants or factors that contribute to measuring the FI of women from a demand-side perspective are identified; and*

(iii) *The combined effect of fintech and FL, and how these two factors complement or supplement each other in promoting FI, is measured.*

Thus, to investigate the role of fintech and FL in driving FI among the women workforce in the informal sector, data were collected from Chennai City in 2024.

MATERIALS AND METHODS

This study investigates the determinants of FI, focusing specifically on FL and Fintech as key influencing variables. FL is measured through the dimensions of financial knowledge, financial skills, and financial attitudes, based on validated constructs from existing literature. Fintech is assessed using structured indicators such as accessibility, cost reduction, and ease of transactions, derived from established conceptual frameworks. A mediation model is applied to test the hypothesis that FL mediates the relationship between Fintech and FI. The model further integrates demand-side factors, including availability, affordability, ease of access, and usage of financial services, to enhance construct validity. Primary data are collected through structured surveys targeting women in the informal sector, using questionnaires translated into Tamil to ensure linguistic and cultural appropriateness. Responses are analyzed using regression techniques and mediation analysis within a Structural Equation Modeling (SEM) framework (Jucunda and Vijay, 2022). All methodological choices, including instrument design, sampling approach, and analytical procedures, are explicitly defined to enhance transparency and replicability within the Indian context.

FI of women in India

There is a notable gender gap in banking activities in almost every society. Women typically have limited ways to utilize the formal financial system's products and services. Due to factors like low assertiveness accumulation, informal and irregular income sources, difficulties with their legal identity, and low financial education, many women avoid using the formal banking system (Kunt and Klapper, 2012; Demirguc-Kunt *et al.*, 2015; Fanta *et al.*, 2016). Since men often hold the majority of the family's economic power, there is a greater likelihood of a bank account in a man's name in every family. Women also participate very little in income-generating activities in developing and less-developed nations. Women participating in fewer economic activities cannot create bank accounts in their names. States with higher proportions of female populations have been found to have lower levels of FI. The patriarchal ideals and customs of Indian society grant men greater privileges than women, and there is a dearth of research examining the hurdles to women's FI in the unorganized sector or the determinants of women's FI. Financial exclusion is Bluemore common in those who experience social exclusion (Ozili, 2020). The Global Findex Database 2014 reveals that socially avoided and stereotyped gender groups, including women, who make up 50% of the world's unbanked population, remain largely excluded from the formal banking system (Demirguc-Kunt *et al.*, 2015). The issue of women and transgender people's exclusion from the formal financial system was not focused on by the researchers (Barik and Sharma, 2021). More research on the FI of women is required, as it directly impacts economic growth and development, and this study aims to address the factors that influence and determine FI, which must be understood to promote its development.

Determinants of FI

The majority of the literature has focused on measuring FI using secondary data and developing the FI index (Sarma, 2008; Sarma, 2012; Singh *et al.*, 2022). Nandru and Rentala (2020) were one of the first few studies to measure FI using demand-side parameters of the tribal groups in Andhra Pradesh. The study concluded that affordability, ease of access to banks, ease of usage of financial services, and availability of financial services are measures of FI. Nandru *et al.,* (2021) analyzed the demand side measures of FI and their impact of FI on the financial well-being of street vendors. The study considered FL, availability of financial services, affordability, accessibility, and ease of usage of financial services as determinants of FI. The results indicated that FI, which paves the way for financial well-being, can never be achieved without FL and that availability, affordability, usage, and ease of access are effective determinants of FI. Grohmann and Menkhoff (2020) argued that financial development influences FI. As per their study, the criteria for FI in developing economies may be holding a mere bank account, but for developed countries, it is the rational utilization of financial resources. Allen *et al.,* (2016) developed three regression models for three measures of FI, such as account ownership, frequency of use, and FI. Among the three regressions, the study found that greater income, good education, a small household, and a proper job were highly related to FI. Based on the extant research, this study takes four determinants of FI from the demand side, derived from the existing literature, including availability, affordability, ease of access, and usage to measure FI.

Measuring FL

Defining and accurately measuring FL is essential to studying its impact on FI. Huston (2010) summarized a broad range of accepted measures of FL. Having summarized 71 studies that discussed FL, this study found that 72% of the studies did not define FL. He identified that FL significantly impacts the financial behavior and well-being of individuals and that financial knowledge is a strong measure of FL. A study done by Togun *et al.,* (2022) found that FL is the capability to have financial product knowledge, knowledge about credit, and the financial math skills to make financial decisions. Cole *et al.,* (2011) stated that customers with basic financial knowledge will be able to make informed decisions, which is a significant part of having a good financial structure in a country. Hasan and Hoque (2021) analyzed the influence of financial knowledge on the use of financial services in Bangladesh. The study identified three ways of accessing financial services: banks, microfinance, and fintech. Using three models of financial access through probit, logit, and log-log regression models, the study found that a lack of financial knowledge acts as an obstacle to attaining

financial development. The study identified that FL did have an influence, a positive one at that, on FI and insisted on the significance of financial knowledge as an influencer on FI. This study measures FL through financial knowledge, financial skills, and financial attitude as determinants.

FL and FI

Though FL and FI are independently studied in most of the literature, the joint impact of both these parameters together hasn't been given as much importance as it should have been (Khan *et al.,* 2023). The capacity to make wise financial decisions by assessing the conditions surrounding it is referred to as FL (Martinez *et al.,* 2013). Understanding financial terms is known as FL or financial education, according to Kostov *et al.,* (2015), and it is reasonable to assume that this knowledge is a prerequisite for any kind of access to financial services. Lack of FL or the inability to understand it is the primary cause of the decline in demand for access to official loan sources (Beck and Le Da Torre, 2007). The lower degree of financial knowledge is typically caused by financial exclusion (Ghosh, 2012). FL has a major impact on FI and ownership behavior, according to a study by Noor *et al*., (2020). Martinez (2016) determined FI by measuring FL as one of the factors. One key component in fostering FI is thought to be financial education (Das and Chouby, 2015). Grohmann and Menkhof (2020) analyzed the relationship between FL and FI. They examined both micro-level and cross-country evidence on FI and FL. The study found that there are three levels of FI: ownership of account, usage of account, and rational use of financial services. The study tells that the first two levels of FI are satisfactory measures for developing economies, while the third level is a factor of measure for developed economies. Further, the study finds that at the macro-level, FL has a causal effect on FI globally, while the causal effect is not proven in micro-level studies. According to Morgan and Long (2020) and Grossmann *et al.,* (2019), there is a desirable correlation between FL and FI. Thus, from the above literature references, this study concludes that *FL has a significant positive impact on FI,* which is hypothesis 1 (H1) of the study.

Fintech and FI

Morgan (2021) analyzed the role of Fintech in increasing FI. The study analyzed how well Fintech and FI correlate with each other in Association of South Asian Nations (ASEAN) member countries and India. It concluded that Fintech increases FI by reducing transaction costs, lowering the cost of business-related payments, enabling transactions without a bank account, and helping small firms access formal financial opportunities easily. Several other research articles have also shown that Fintech has a significant positive impact on FI (Kirana and Havitz, 2020; Martin *et al.,* 2021; Mutamimah and Indriastuti, 2023), but research on Fintech and FIs' relationship is still in the nascent stage. Thus, it can be stated that *'Fintech has a significant positive impact on FI,'* which is hypothesis 2 (H2) of the study.

The nexus between Fintech, FL, and FI

Research examining the effect of both fintech and FL on FI has shown mixed and contradicting evidence on their interrelationships. The academic literature is still not in consensus on how these three factors are related to each other. Marini *et al.,* (2024) analyzed the impact of FL, fintech, and FI on Micro, Small, and Medium Enterprises (MSMEs) performance in Bengkulu City using regression analysis. The study identified that FL didn't have much of an impact on FI, while fintech did have an impact on FI. Togun *et al.,* (2022) analyzed FL as a mediator between the relationship of FI and the performance of Small and Medium Enterprises (SMEs). The study was conducted on Nigerian SMEs. The study argued that the majority of SMEs in Nigeria were unbanked despite developed financial services only because their FL levels were very low. Their findings showed FL partially mediates the relationship between FI and SMEs performance Klapper and Lusardi (2020) examined FI and FL and studied their relationship and came to the conclusion that people who do not have ownership of bank accounts had lower FL levels compared with people who own accounts. Mutamimah and Indriastuti (2023) examined FL being the role of the moderator in the effect of fintech on FI in Indonesian SMEs. The findings of their study suggested that fintech cannot increase financial performance and that FL does not moderate or strengthen the bond between fintech and FI. The study attributed the findings to the weak understanding and poor use of technology in financial products and services among Indonesian SMEs. Kirana and Havitz (2020) examined the validity of FL and fintech as determinants of FI in Indonesia.

The study identified Financial Attitude (FA), Financial Skill (FS), and Financial Knowledge (FK) as indicators of FL, and two variables of the Technology Acceptance Model (TAM) as indicators of fintech. Using multiple regression on the data collected from 100 respondents, the study found that, except for financial attitudes, all the other independent variables were significant and that the increase in FL and the increase in using mobile phones for payment in turn increase FI. Martini *et al.,* (2021) analyzed the moderating impact of FL in the relationship between fintech and FI in Indonesia. The paper substitutes variables from the TAM model as indicators of fintech, and FL was tested as a moderator to determine if it strengthened the relationship between FI and fintech. Collecting primary data from 8 districts of Lubuklinggau, PLS analyses were employed to analyze the direct and indirect relationship between the variables. The results suggested that FL was able to impact the perception of ease of use and reduced risk in fintech (two indicators out of 4 tested for fintech). However, one of the unique findings of the study is that as FL grew among people, their interest in the usage of fintech reduced, and they started to use more selective plans. From the extensive literature, it can be seen that FL has been used as a moderator

or a mediator in the relationship between fintech and FI. Most of the studies that have used FL as a moderator have concluded that it couldn't moderate the relationship, whereas studies that have used FL as a mediator have found it to be an effective mediator between fintech and FL. However, it could be said that the relationship between fintech and FI may be stronger in the presence of FL. Thus, the authors state the third hypothesis (H3) as *'FL mediates the relationship between Fintech and FI.'* The conceptual framework between Fintech, FL, and FI is presented in Fig. 1. From Fig. 1, it can be seen that there are interrelationships between FL and FI, with various factors influencing both. Hypotheses H1 and H3 serve as connecting elements between FL and FI, suggesting that improving FL can enhance FI. Hypothesis H2 bridges the gap between Fintech and FI, highlighting the role of technological advancements in promoting inclusion. Additionally, FA, FS, and FK are key factors related to FL, emphasizing the importance of accessibility, services, and knowledge in improving FL. Meanwhile, availability, ease of access, and usage affordability are crucial components of FI, ensuring that financial services are accessible, affordable, and usable by underserved populations. Together, these factors demonstrate how FL and inclusion are
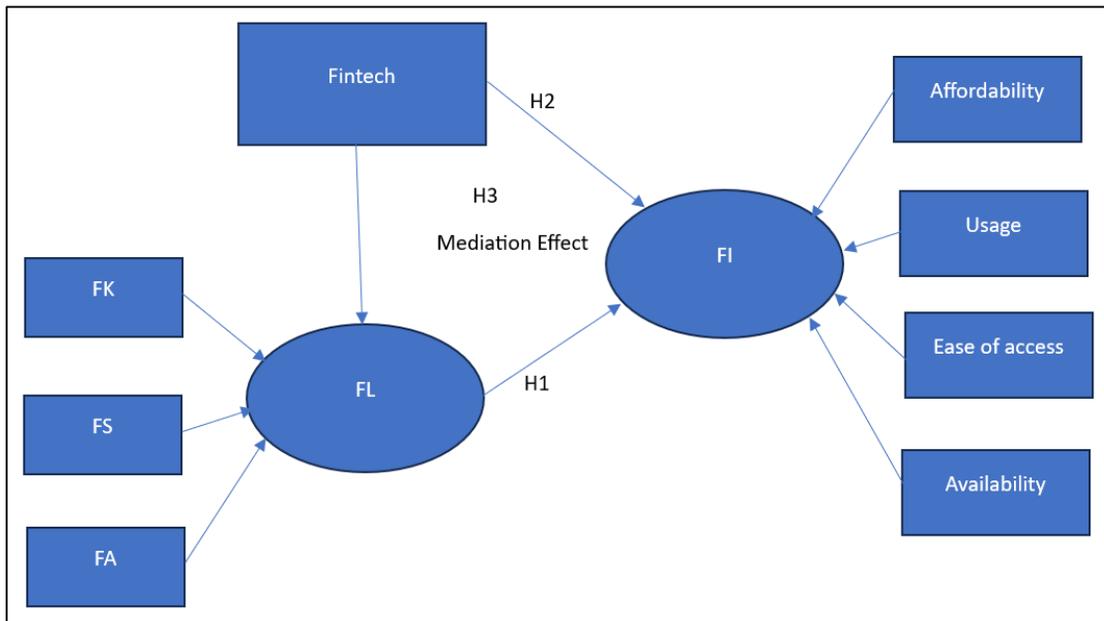

Fig. 1: Conceptual framework

interconnected and influenced by both traditional and technological elements. Fig. 1 concludes that improving FL can enhance FI, with technological advancements in Fintech playing a key role in bridging the gap between them. Factors such as accessibility, services, and knowledge are critical for FL, while availability, ease of access, and affordability are essential for ensuring FI. This visual framework underscores how both traditional and technological elements are interdependent in promoting FL and inclusion.

Conceptual foundation

Building on this conceptual framework, the research questions in this study are anchored in a structure that interrelates FI, FL, and fintech. Prior studies emphasize that FI is a critical component of sustainable economic development and directly contributes to SDGs, particularly SDG 5 (Gender Equality) and SDG 10 (Reduced Inequalities). Although fintech has emerged as a tool for improving access to financial services, especially among underserved populations, its true impact is contingent upon users' financial capabilities. This study builds on the premise that FL is not merely a complementary skill but a mediating factor that determines whether fintech adoption leads to meaningful financial inclusion. Therefore, the research questions are framed to explore the strength and nature of these interdependencies, particularly how FL mediates the relationship between fintech and FI.

Empirical evidence

Empirically, the study identifies a noticeable gap in the existing literature concerning demand-side determinants of FI, especially within marginalized communities such as women in India's informal workforce. While fintech's potential to expand financial access has been extensively acknowledged, the role of FL in enabling users to effectively navigate and utilize these digital financial tools has not received equivalent scholarly attention. Most previous research either overlooks the interaction between fintech and FL or focuses primarily on supply-side factors like infrastructure and policy. The current study addresses this gap by empirically testing whether FL enhances the effectiveness of fintech in promoting FI, with a specific focus on women in Chennai's informal sector.

Contextual relevance

The formulation of the research questions is also deeply informed by the socio-economic and geographic context of the study. In India, a significant portion of the female labour force remains engaged in the informal sector, where access within formal financial systems continues facing structural and cultural barriers. Urban centers such as Chennai, with high levels of informal employment among women, present a critical opportunity in examining how digital financial tools economically empower women. The success of fintech in this environment depends not only on its availability but also on the end-users' financial understanding and engagement with available tools. Investigating how FL enables women in this sector to fully benefit from fintech solutions allows the study to contribute actionable insights that support inclusive economic development and align with India's broader vision under initiatives such as Viksit Bharat 2047.

Survey design and data collection

The study employed a confirmatory quantitative research method using SEM. A structured questionnaire was used in this study to collect data, with both computer-based and in-person surveys conducted in Chennai to test and verify the hypothesis. In India, 94% of the women are employed in the informal sector, and that is why the authors chose women in the unorganized sector for the study. More than 57% of the workers in the Mahatma Gandhi National Rural Employment Guarantee Scheme are women, and about 70% of India's domestic workers are women (National Commission for Women, 2024). Also, Chennai is a place where women from all over Tamil Nadu come to work as domestic workers in households and organizations. That is the reason to choose Chennai, as it'll be a representation of both urban India and also a representation of women all over the state. The questionnaires were framed using A Likert scale with responses from 1 to 5, where 1 is 'strongly disagree' and 5 is 'strongly agree'. The respondents were given each question in their native language, Tamil, and answers were coded by the researcher. The research was conducted in the Chennai area, and the snowball sampling method was used by the researchers to reach a wide range of women employed in different informal sectors. The authors, along with students and scholars,

circulated the questionnaire to friends and family, requesting them to gather data from women workers in their households, nearby shops, roadside vendors, community workers, etc., for over 8 weeks. Since both paper-pencil and online methods of data collection were employed, an independent sample t-test was run to verify the procedures. The effect sizes are regarded as inconsequential when they are smaller than 0.3 (Cohen, 1992). As a result, the techniques used to obtain the data were the same.

Measurement

The study's measurement variables were drawn from earlier research publications. The "FL" measurement scale items are taken from Rastogi and Ragabiruntha (2018) and Noor *et al.,* (2020), which were further divided into three sub-dimensions: financial skill, financial knowledge, and financial attitude. The metrics for "usage" (Salathia, 2015), "accessibility" (Bongomin *et al.,* 2020), "affordability", "availability", and "FI" (Salathia and Androtra, 2015) are drawn from research studies. The metrics for measuring fintech were developed and referenced from the Asian Economic Policy Review (Morgan, 2021).

RESULTS AND DISCUSSIONS

The data screening process identified and removed 25 outliers, yielding 302 valid responses. EFA confirmed unidimensionality with acceptable factor loadings and reliability (Cronbach's alpha > 0.7). Sampling adequacy was supported (KMO = 0.813), and no multicollinearity issues were found (VIF < 10). CFA validated the measurement model, ensuring construct reliability. SEM then assessed direct and indirect relationships, supporting the proposed hypotheses.

Data screening

Examining the role of financial technology and financial literacy in driving financial inclusion among women in the workforce within the informal sector, the authors began by identifying anomalies within the collected data through a rigorous screening process. This initial step ensured data integrity and reliability, which is crucial when analyzing financial behavior among underserved populations. Exploratory Factor Analysis (EFA) verified that the selected components, such as financial technology adoption, financial

literacy levels, and financial inclusion indicators, were unidimensional and statistically sound. Analysis of Moment Structures (AMOS), version 22.0, tested the proposed model through a two-stage SEM approach (Anderson and Gerbing, 1988), ensuring that the relationships among key variables were accurately assessed. At this stage, the validity and reliability of the measurement scales were evaluated through Confirmatory Factor Analysis (CFA), ensuring that the constructs accurately captured financial literacy, technology usage, and inclusion levels among women within the informal workforce. A structural model analyzed both direct and indirect relationships, shedding light on how financial technology and literacy interact, influencing financial inclusion outcomes among women within the informal economy.

Data analysis

Identifying univariate outliers involved the use of standardized values (z-scores) and box plots, ensuring that extreme data points did not distort the analysis of financial technology adoption, financial literacy levels, and financial inclusion among women in the informal sector. Mahanobis' distance was applied to detect multivariate outliers, addressing anomalies that could affect the relationships among key variables (Hair *et al.,* 2010). Through this process, 25 outliers were identified and removed, refining the dataset for more accurate and reliable results. As a result, 302 valid responses were retained, providing a robust foundation for examining how financial literacy and technology contribute to financial inclusion for women in the informal workforce.

EFA

The factors of the questionnaire were measured using the Likert scale. The fifty-five items in the questionnaire have been tested for standardization and factor loadings using principal component analysis and varimax rotation with EFA. All the factor loadings were between 0.592 and 0.883. Cronbach's alpha test was used to test for reliability, and in all the constructs, the values were in the range of 0.7 to 0.913 and were above the accepted threshold level of 0.7 (Hair *et al.,* 2010). The results of the EFA are presented in Table 1. Bartlett's test of sphericity requires a sampling adequacy of 0.6 (Haridasan *et al.,* 2021), and the EFA analysis provided a KMO

Table 1: Factors influencing FI among women in the informal sector: availability, accessibility, affordability, usage, FL, and fintech adoption

Factor	Items/Statement	Loadings	Eigen Value	% of Variance Explained	Cronbach Alpha	Mean	SD
Availability (Nandru and Rentala, 2020)	My bank branch is very close to my home	0.761	11.265	21.255	0.700	3.377	0.669
	ATM is very close to my home	0.780					
	The post office is very close to my home	0.760					
	SHG's loans are available	0.739					
	My bank employees are very helpful in explaining the products and services	0.632					
	My bank has locker facilities	0.65					
	Availability of No frills	0.709					
	Bank branch providing credit facility counseling	0.714					
Ease of Access (Nandru and Rentala, 2020)	I can easily avail myself of bank loans through SBLP	0.785	5.14	9.698	0.818	3.158	0.856
	I can easily open a bank account through the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS)	0.684					
	I can very easily open a bank account through SBLP	0.794					
	I can avail of a house loan easily if I want	0.747					
	Not many documents are required for opening bank accounts	0.763					
	I can easily avail of a gold loan	0.775					
Affordability (Nandru and Rentala, 2020)	I can afford the interest rate on SHG loans	0.742	4.075	7.69	0.875	3.505	0.848
	I can afford the interest rate on a vehicle loan	0.742					
	I can afford the interest rate on a gold loan	0.792					
	I don't have to spend much to open a bank account, and it is affordable for me	0.712					
	The charges for availing bank facilities are not too much	0.753					
	I can have a bank account with a zero balance	0.786					
	The fee charged for the usage of a debit or credit card is minimal	0.723					
Usage (Nandru and Rentala, 2020)	I save money in the bank constantly	0.576	3.904	7.366	0.799	3.249	0.771
	I often visit bank branches to withdraw money	0.698					
	My bank has locker facilities, and I use them	0.583					
	I often withdraw money from ATMs using a debit card	0.719					
	I got a crop loan through my bank account	0.673					
	I often visit my bank to transfer money	0.777					
	I use a bank account to receive wages under the scheme of MGNREGS	0.773					
	I visit my bank branch regularly for repayment of the loan amount	0.665					
	I use bank accounts to avail of the SHG loan	0.712					

Continued Table 1: Factors influencing FI among women in the informal sector: availability, accessibility, affordability, usage, FL, and fintech adoption

Factor	Items/Statement	Loadings	Eigen Value	% of Variance Explained	Cronbach Alpha	Mean	SD
Financial Knowledge (Noor *et al.,* 2020; Rastogi and Ragabiruntha, 2018)	I'm aware of the various schemes like PMDJY, Atal Pension Schemes, Mudra Scheme, etc.	0.673					
	I can understand the scheme and its structure	0.769					
	I'm aware of the basic interest rate calculations of those schemes	0.792	2.959	5.583	0.813	3.475	0.886
	I'm able to understand the concept of inflation and how it affects the interest rates	0.748					
	I know the importance of saving in my daily life	0.782					
	I know how to manage my income and allot money for savings	0.780					
Financial Skills (Noor *et al.,* 2020; Rastogi and Ragabiruntha, 2018)	I can make interest rate calculations on my own	0.592					
	I can add, subtract, divide, and multiply numbers	0.689					
	I can fill out my application form when opening an account	0.797	2.158	4.072	0.814	4.050	0.680
	I can identify numbers and understand how much they are	0.71					
	I know the difference between compound interest and simple interest	0.736					
Financial Attitude (Noor *et al.,* 2020; Rastogi and Ragabiruntha, 2018)	I need savings to be an integral part of my life.	0.735					
	Minimizing expenditure and maximizing savings is good for my family and me.	0.833	2.054	3.876	0.79	4.190	0.691
	Save today for a better tomorrow.	0.73					
	I want to learn more about personal finance	0.729					
Fintech (Morgan, 2021)	I use Fintech every day for my financial transactions.	0.671					
	My transaction cost of business-related payments is reduced because of fintech use compared to other types of payments, such as credit cards.	0.738					
	I can use Fintech without having a bank account.	0.629					
	I need not visit banks or ATMs for any transactions, which makes using fintech more advantageous.	0.68	1.568	2.959	0.913	3.607	0.824
	Being in the informal sector, fintech enables me to engage in e-commerce easily.	0.688					
	Fintech makes credit facilities more obtainable and the process transparent.	0.722					
	I learned about various financial products and schemes through fintech.	0.658					
	I'm aware of financial products (eg, Cryptocurrency, ETF, SGB, etc.)	0.689					
	Fintech helps me use banking products and services more effectively	0.755					

(Kaiser-Meyer-Olkin) value of 0.813, which is above the needed sampling adequacy. The total variance extracted for the seven constructs was 62.44%, and the eigenvalues met the threshold criteria. No deviation was observed from the structure of the adapted constructs, as all the items load 0.6 or higher on the hypothesized factor (Hair *et al.,* 2016). A test of multicollinearity was done using VIF (Variation Inflation Factor), and the values ranged from 1.303 to 1.826, which were below the recommended critical value of 10 (Hair *et al.,* 1992).

Table 1 explores the influence of fintech and FL on FI among women in the informal sector across multiple dimensions, including availability, accessibility, affordability, usage, financial knowledge, financial skills, financial attitude, and fintech adoption. The findings align with and expand upon prior research, particularly studies by Nandru and Rentala (2020), Noor *et al.*, (2020), Rastogi and Ragabiruntha (2018), and Morgan (2021). The comparative analysis provides insights into how these results corroborate or diverge from previous findings.

i.   Availability of financial services and fintech integration: Nandru and Rentala (2020) emphasized that the physical presence of financial institutions plays a crucial role in FI. Access to bank branches, ATMs, and Self-Help Group (SHG) loans significantly influences financial participation. The findings confirm this, with factor loadings highlighting bank accessibility (0.761), ATM availability (0.780), and SHG loans (0.739) as key contributors. While earlier studies focused on traditional banking infrastructure, this research underscores the growing role of fintech in bridging accessibility gaps, especially in remote areas with limited banking facilities.

ii.   Ease of access and simplification of financial processes: The ease of accessing financial services is a significant driver of FI, with simplified banking processes such as SHG-Bank Linkage Programs (SBLP) and MGNREGS reducing procedural barriers (Nandru and Rentala 2020). The study confirms that ease in opening bank accounts (0.684) and obtaining loans (0.785) positively influences financial participation. Minimal documentation requirements (0.763) further encourage financial engagement. While previous studies focused on traditional banking, this research highlights fintech's role in streamlining financial transactions, reducing dependency on physical banking infrastructure, and enhancing accessibility.

iii.   Affordability and cost-effectiveness of financial services: Affordability remains a crucial determinant of FI, with access to low-cost financial services increasing participation (Nandru and Rentala 2020). The findings confirm this, with significant factor loadings for affordable SHG loans (0.742), vehicle loans (0.742), and gold loans (0.792). Maintaining a low-cost bank account (0.712) encourages financial engagement. While earlier research focused on affordability within traditional banking, these results highlight fintech's role in reducing transaction costs (0.738), enhancing financial accessibility, and expanding credit options for women in the informal sector.

iv.   Usage patterns and digital financial transactions: Active engagement in financial services is key to FI, as frequent savings, withdrawals, and loan repayments indicate deeper financial involvement (Nandru and Rentala 2020). The findings confirm that women actively save in banks (0.576), withdraw from ATMs (0.719), and utilize accounts for government scheme payments such as MGNREGS (0.773). Unlike previous studies that focused on traditional banking transactions, this research highlights fintech's growing role in facilitating digital financial transactions (0.680), reducing dependency on brick-and-mortar banking, and enhancing financial participation.

v.   Financial knowledge and awareness of digital financial tools: FL is critical to FI, as knowledge of government schemes, interest rate calculations, and inflation concepts helps individuals make informed financial decisions (Noor *et al.,* 2020, and Rastogi and Ragabiruntha, 2018). The findings validate this, showing that awareness of government schemes (0.673), financial concepts (0.769), and savings management (0.780) significantly influence FI. While previous research emphasized traditional FL, this study extends its scope by demonstrating fintech's role in financial education. Exposure to digital financial products such as cryptocurrency and ETFs (0.689) suggests that fintech platforms act as both financial service providers and educational tools.

vi.   Financial skills and technology-enabled financial management: Financial skills, such as performing interest calculations and completing application forms, are essential for financial independence (Noor *et al.,* 2020, and Rastogi and Ragabiruntha, 2018). The study confirms

the importance of arithmetic skills (0.689) and proficiency in completing financial applications (0.797) in improving financial participation. Unlike earlier studies, these findings highlight fintech's role in simplifying financial management for individuals with lower financial skills. Digital platforms enable users to access financial services without requiring advanced numerical proficiency, promoting greater financial engagement among women in the informal workforce.

vii. Financial attitude and proactive financial behavior: A proactive approach to saving and financial planning significantly influences FI (Noor et al., 2020, and Rastogi and Ragabiruntha, 2018). The findings confirm that a strong inclination toward saving (0.735) and minimizing expenditure (0.833) contribute to financial participation. Fintech platforms further encourage financial awareness, as the desire to learn about personal finance (0.729) is positively influenced by digital financial resources. Unlike previous research that primarily focused on behavioral aspects of saving, this study suggests that fintech not only facilitates transactions but also fosters positive financial habits.

viii. Fintech as a catalyst for FI: Fintech is recognized as a critical enabler of FI due to its ability to reduce transaction costs, improve credit accessibility, and enhance FL (Morgan 2021). The findings strongly support this, showing the positive impact of fintech on daily transactions (0.671), cost reduction (0.738), and credit accessibility (0.722). Previous studies established that fintech benefits individuals without traditional bank accounts (Morgan 2021). This research confirms that women in the informal sector can access fintech services without conventional banking infrastructure (0.629). Additionally, fintech platforms serve as financial education tools, improving knowledge about financial products such as cryptocurrency and ETFs (0.689) and enhancing financial decision-making capabilities.

The findings confirm and expand upon prior research, demonstrating that fintech and FL play pivotal roles in FI among women in the informal sector. While conventional factors such as availability, affordability, and financial knowledge remain influential, fintech introduces new opportunities for digital inclusion, cost reduction, and financial education. Enhancing fintech accessibility and promoting FL will be crucial in fostering greater financial participation among women in the informal workforce.

Hypothesis testing

The authors used CFA to evaluate the degree to which the measurement is consistent with the real and actual. CFA allows the examination of the fit indices and parameter estimates. SEM in CFA illustrating relationships among latent and observed variables in the context of fintech is presented in Fig. 2. The model includes FL as a latent variable, comprising financial knowledge, skills, and attitude, and FI, which includes usage, affordability, ease of access, and availability. Arrows indicate relationships between variables, with path coefficients such as financial knowledge to financial literacy (3.18) and financial literacy to fintech adoption (3.62). Error terms associated with observed variables (e1 to e7) indicate unexplained variances, such as e1 (0, 0.60), while covariances between latent variables, such as financial literacy and financial inclusion (0.12), are represented by curved arrows. The model visually captures the interactions between financial literacy, financial inclusion, and fintech usage, offering insights into the strength and direction of these relationships. The CFA results support the model's fit. The chi-square value (χ^2) was 69.659 with 15 degrees of freedom (df), and a significance level of p = 0.000. Fit indices included a Comparative Fit Index (CFI) of 0.914, a chi-square to degrees of freedom ratio (χ^2/df) of 4.644, a Tucker-Lewis Index (TLI) of 0.840, a Normed Fit Index (NFI) of 0.90, and a Root Mean Square Error of Approximation (RMSEA) of 0.111. The chi-square value indicates that the model effectively represents the data, with widely accepted fit indices confirming overall model adequacy.

After confirming the fit of the measurement model using CFA, a structural model was tested using SEM. The SEM, which reveals the complex relationships between financial literacy, financial inclusion, and Fintech adoption, is presented in Fig. 3. Financial Knowledge, Skills, and Attitude significantly enhance Financial Literacy (path coefficients: 3.18, 3.63, and 4.27, respectively), which in turn strongly influences Fintech adoption (3.62). Financial Inclusion also impacts Fintech adoption (1.45), though to a lesser extent. The error terms for observed variables (e1 to e7) indicate the unexplained variances, such as e1 (0, 0.60). Positive covariances between latent
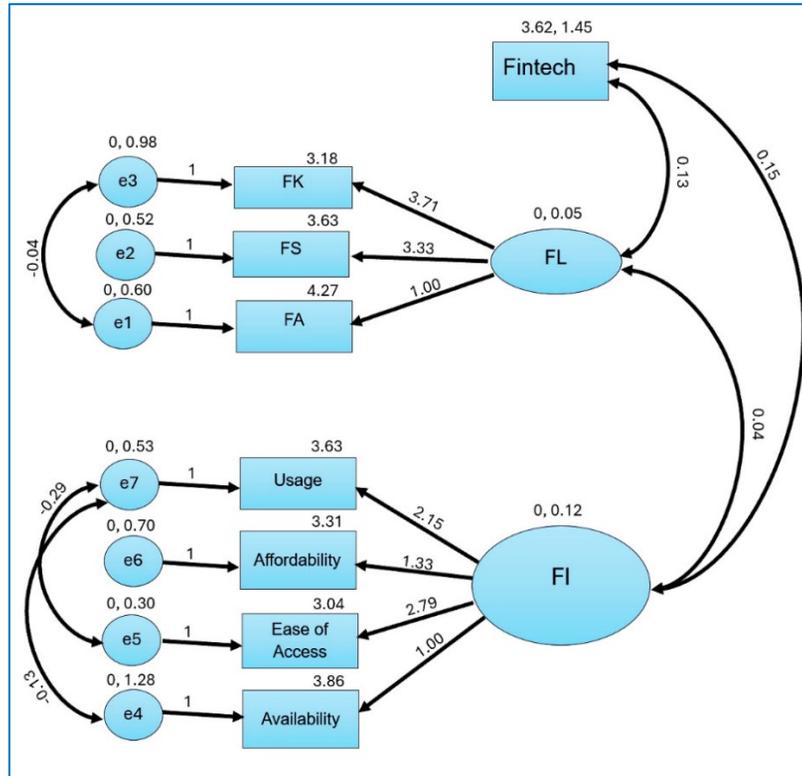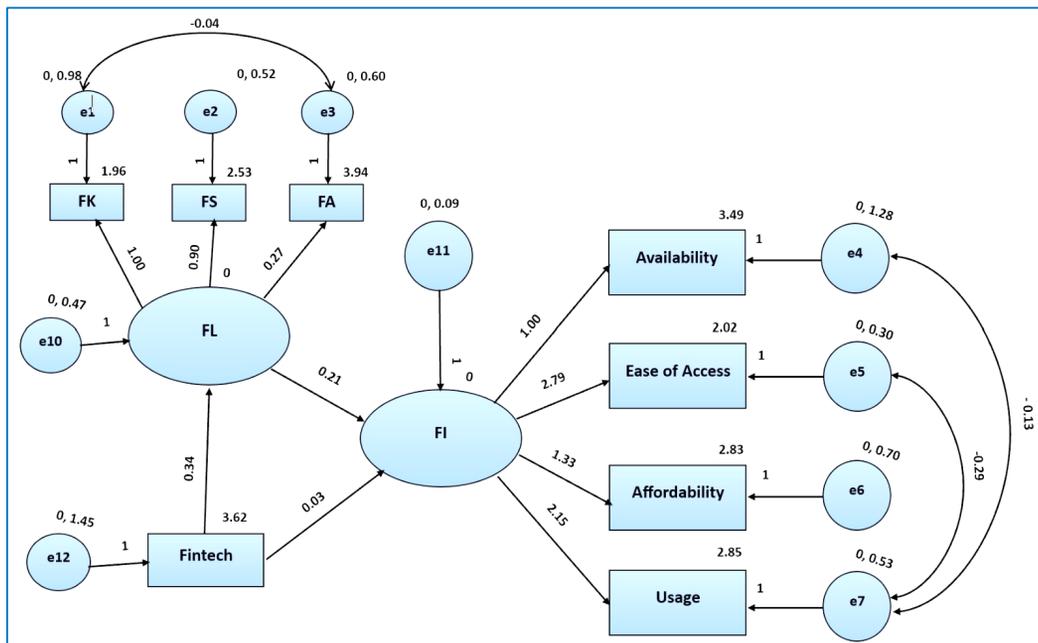
Fig. 2: CFA

Fig. 3: SEM

Table 2: Impact of Fintech and FL on FI hypothesis testing

Hypothesis	Independent Variable	Dependent Variable	Estimate	p-value
H1	Fintech	FI	0.347	0.001
H2	FL	FI	0.457	0.001
H3	Fintech (after introducing the mediating variable)	FI	0.481	0.001

variables, such as FL and FI (0.12), highlight their interrelationships. The results suggest that improving financial knowledge, skills, and attitudes is crucial for promoting Fintech adoption, with financial literacy playing a more pivotal role than financial inclusion. Policymakers and educators should focus on financial education programs to enhance financial literacy, thereby fostering greater Fintech usage. This model offers valuable insights for understanding the dynamics of financial behaviors and outcomes.

The measurement model's fit indices results are as follows: χ^2 value = 69.659 with 15 degrees of freedom (χ^2/df = 4.644, p = 0.000), Comparative Fit Index (CFI) = 0.914, Non-Normed Fit Index (NFI) = 0.90, Tucker-Lewis Index (TLI) = 0.840, and Root Mean Square Error of Approximation (RMSEA) = 0.111. The chi-square value indicates that the model is adequately fit, showing no significant difference between the observed and measured model covariance matrices. The widely accepted fit indices confirm the model's overall fit, supporting its reliability in assessing financial inclusion. Fig. 2 demonstrates strong factor loadings, with financial knowledge at 1.51, financial skills at 0.97, financial attitude at 1.00, ease of access at 1.31, usage at 0.99, affordability at 0.90, and availability at 1.00, indicating strong relationships between these constructs and financial inclusion. According to Hu and Bentler (1999) and Haridasan *et al.,* (2021), Modification Indices (MI) and parameter changes (Par change) were examined to assess whether the equality constraints were violated, and results confirmed that all factor loadings remained stable. This suggests that the hypothesized relationships between constructs were well-defined, without the need for additional modifications to the model. To estimate parameters, the Maximum Likelihood (ML) method was applied due to its efficiency and robustness under the assumption of multivariate normality. This approach ensures that unique values are generated for free parameters, improving model precision and reliability. The SEM results confirm that financial literacy and fintech

adoption significantly contribute to financial inclusion among women in the informal sector, with strong factor loadings indicating the critical role of financial knowledge, skills, attitudes, and access to digital financial services.

Table 2 presents the results of hypothesis testing, demonstrating the relationships between fintech, financial literacy, and financial inclusion among women in the informal sector. The findings indicate that fintech significantly influences financial inclusion (β = 0.347, p = 0.001), supporting the premise that digital financial services improve access to financial resources. Financial literacy also has a strong positive impact on financial inclusion (β = 0.457, p = 0.001), highlighting the critical role of financial knowledge, skills, and attitudes in enabling women to engage with financial services effectively. The introduction of financial literacy as a mediating variable further strengthens the impact of fintech on financial inclusion, with the beta coefficient increasing from 0.347 to 0.481. This suggests partial mediation, meaning that fintech enhances financial inclusion both directly and indirectly through its influence on financial literacy. These results emphasize that while fintech provides digital access to financial services, its effectiveness in promoting financial inclusion is maximized when individuals possess adequate financial literacy. Women in the informal sector often face barriers such as a lack of formal banking access, low digital literacy, and limited awareness of financial products.

The study underscores that simply introducing digital financial services is insufficient; financial literacy initiatives must accompany fintech expansion to ensure meaningful financial inclusion. Policymakers and financial institutions should focus on developing programs that enhance financial literacy while promoting fintech solutions. This can include digital training programs, simplified user interfaces, financial applications, and targeted awareness campaigns. Strengthening financial literacy enables women in the informal sector to better navigate digital financial

services, leading to greater financial independence, improved savings behavior, and enhanced economic security. The results affirm that fintech, when combined with financial literacy, serves as a powerful driver of financial inclusion, enabling women to participate more actively in the financial ecosystem. The study analyzed the significance and relationships among fintech, FL, and FI among women in the informal sector in Southern India. Measurement scales were developed from existing literature, and EFA was used to standardize constructs. Cronbach's alpha test confirmed reliability, and SEM was applied to test hypotheses. Findings highlight the critical role of fintech and FL in promoting FI. Consistent with previous studies (Martinez *et al.,* 2013; Kostov *et al.,* 2015), FL emerged as a significant determinant of FI among women in the unorganized sector in India. Higher financial knowledge enables informed financial decision-making (Lusardi and Mitchell, 2014). This is particularly important among women, where limited access to traditional banking services directly affects financial participation (Lyons and Kass-Hanna, 2021). The positive influence of fintech on FI aligns with existing literature (Morgan and Long, 2020; Mutamimah and Indriastuti, 2023; Martini *et al.,* 2021; Kirana and Havitz, 2020), reinforcing the role of technology-driven financial services in bridging access gaps. Digital financial platforms reduce barriers to entry, lower transactional and operational costs, and provide accessible services, even without conventional bank accounts (Arner *et al.,* 2016). However, findings indicate that FL mediates the relationship between FI and fintech. This underscores FL as a prerequisite for effectively leveraging fintech to achieve FI (Kirana and Havitz, 2020; Marini *et al.,* 2024; Martini *et al.,* 2021). Without adequate financial knowledge, fintech alone cannot ensure inclusion, as access to financial services must be complemented by the ability to navigate and utilize them effectively. Policy implications emphasize the need for prioritizing FL initiatives within FI strategies. Policymakers should design targeted financial education programs for women in the informal sector, addressing specific financial challenges to enhance confidence and capability in accessing financial services (OECD, 2017). Government initiatives on FL remain largely channeled through non-governmental organizations (NGOs) to reach rural populations, highlighting the necessity of focusing on educational measures

rather than merely introducing new FI schemes. FL plays a crucial role in achieving SDGs, particularly SDG 4 (quality education), SDG 5 (gender equality), and SDG 8 (decent work and economic growth). Raising awareness among women in the informal sector about FL can improve financial management and decision-making. Developing fintech solutions tailored to the needs of women requires regulatory bodies to foster an enabling environment. Many women entrepreneurs in the informal sector face difficulties accessing formal credit due to digital platforms not being available in regional languages. Addressing such barriers can enhance inclusion within the financial system. Beyond language accessibility, tackling gender disparities remains essential to ensuring equitable access to financial services. Fintech companies can integrate FL into their platforms through interactive tutorials and advisory features, enabling women to make informed financial decisions (Desello and Agner, 2023; Zins and Weill, 2016). Designing inclusive financial products aligns with the broader goal of enhancing accessibility and usability. Collaboration among fintech firms, educational institutions, and non-profit organizations can create synergistic effects, leveraging collective expertise and resources to expand FL and inclusion. Policymakers can further support FI through community-based initiatives that bring together women in the informal sector, investing in research that identifies their specific financial needs and tailoring policies accordingly. Expanding FL and ensuring inclusive digital financial services can contribute to reducing economic disparities, empowering women, and fostering sustainable financial participation.

Recommendations

This study highlights the crucial role of FL and fintech in enhancing FI among women in the informal sector. To bridge existing gaps and ensure effective financial participation, the following recommendations are proposed:

i. *Enhance FL programs:* Policymakers should implement targeted financial education initiatives focusing on digital transactions, savings, and financial decision-making.

ii. *Integrate FL in fintech solutions:* Fintech companies should embed educational tools, tutorials, and personalized financial advice into their platforms to improve user understanding and engagement.

iii. *Develop inclusive fintech solutions:* Regulatory bodies should mandate the development of fintech products in regional languages with simplified interfaces to improve accessibility for women with low digital literacy.

iv. *Address barriers to FI:* Governments and financial institutions should conduct awareness campaigns and introduce simplified digital onboarding processes to eliminate socio-cultural and technological barriers.

v. *Strengthen public-private partnerships:* Collaboration between fintech firms, government agencies, and NGOs can create comprehensive FI strategies tailored to the needs of women in the informal workforce.

vi. *Monitor and evaluate FI initiatives:* Regular assessment of FL and fintech adoption programs will help refine policies and ensure long-term financial empowerment.

Future scope of the study

The role of fintech and FL in driving FI among women in the informal sector remains a crucial area of study, particularly in urban regions like Chennai, where a significant portion of the female workforce is engaged in informal employment as domestic workers, street vendors, and cleaners. While FI has been widely studied in India, limited research has focused on demand-side factors and the specific challenges faced by vulnerable groups such as women, senior citizens, transgender individuals, and persons with disabilities. This study highlights the importance of fintech and FL as key drivers of FI and establishes FL as a mediating factor in the relationship between fintech and FI. The findings emphasize that while fintech enhances access to financial services, its effectiveness depends on FL, which enables individuals to utilize digital financial tools efficiently. Despite the introduction of several government schemes promoting FI, their impact remains limited without adequate financial education. Therefore, future research should explore additional dimensions influencing FI, addressing behavioral aspects, barriers, and the long-term effects of fintech adoption. Future research directions include:

i. *Financial attitude and decision-making:* Investigating how financial attitudes among women in the informal sector influence their financial decisions. Understanding behavioral

factors, cultural perceptions, and economic constraints can provide insights into designing more effective FL programs.

ii. *Barriers to FI:* Identifying and analyzing obstacles such as digital illiteracy, lack of access to financial services, socio-cultural constraints, and regulatory limitations. Exploring how fintech solutions can overcome these barriers will help in tailoring financial products to meet the needs of women in the informal workforce.

iii. *Impact of FL initiatives:* Evaluating the effectiveness of FL programs, particularly those focused on digital finance, mobile banking, and digital payment systems. Research should assess how these initiatives enhance women's ability to access and use financial services effectively.

iv. *Sustainability and long-term effects:* Conducting longitudinal studies to examine the sustained impact of fintech adoption and FL programs on FI. Comparative studies across different demographic groups and geographic regions can provide a broader perspective on financial behavior and inclusion strategies.

v. *Integration of FL in fintech platforms:* Exploring ways fintech companies can embed FL tools into their platforms. Features such as interactive tutorials, financial decision-making guidance, and AI-driven financial assistance could empower women to navigate financial services more effectively.

Addressing these research gaps, future studies can contribute to a more inclusive financial ecosystem, ensuring sustainable economic empowerment for women in the informal sector.

CONCLUSIONS

Finance constitutes a foundational element of any national economy, with increasing relevance as global systems transition toward sustainability. FI serves as a cornerstone of sustainable financial development, directly supporting SDGs such as SDG 1 (No Poverty) and SDG 8 (Decent Work and Economic Growth). The financial inclusion of women further aligns with SDG 5 (Gender Equality) and SDG 10 (Reduced Inequalities). The advent of fintech has introduced transformative mechanisms for enhancing access to FS, contributing to SDG 9 (Industry, Innovation, and Infrastructure). This study evaluates the integrated impact of fintech and FL on

advancing FI among the female workforce engaged in Chennai's urban informal sector. Urban FM among women remains a critical area of inquiry due to their substantial contributions to national economic development. Chennai comprises a significant concentration of informal women workers, including domestic workers, street vendors, and cleaners, who frequently remain excluded from formal financial systems. Although previous studies have examined FI within India, limited research addresses demand-side determinants or focuses on marginalized groups such as women, senior citizens, transgender individuals, and persons with disabilities. The present study emphasizes the synergistic role of fintech and FL in improving FI among women in the unorganized sectors. Data were collected from women employed in the informal sector using snowball sampling, and a structured questionnaire was administered. SEM was employed to test the proposed hypotheses. Findings reveal that both fintech and FL exert statistically significant positive effects on FI. A key result demonstrates that FL functions as a mediating variable in the relationship between fintech and FI. Thus, even comprehensive financial schemes introduced through government initiatives may yield limited impact in the absence of adequate FL. Policy efforts should extend beyond the creation of schemes toward establishing comprehensive FL interventions. This study contributes to existing literature by identifying FL as a frequently overlooked determinant of effective FI. Despite increasing fintech adoption, FL remains a prerequisite for realizing inclusive outcomes. The findings underscore the necessity for policymakers, regulatory authorities, and fintech providers to prioritize financial literacy centers and structured empowerment programs targeting women. Enhanced financial awareness enables women to more effectively utilize and benefit from digital financial instruments. The study introduces a novel direction in academic discourse by addressing the limited understanding of the interdependencies among fintech, FL, and FI. A theoretical contribution is offered through a custom-designed questionnaire based on India-specific fintech constructs, advancing beyond the commonly used TAM. The study holds significant implications for policymakers, regulatory bodies, financial institutions, and fintech enterprises. Future research may further investigate the influence of financial attitude among women and associated socioeconomic and behavioral determinants. Findings reaffirm that fintech may support FI only in the presence of adequate FL. While this study focused on establishing relationships among key constructs, future research should explore barriers to financial inclusion and examine how fintech innovations may address these challenges across women in the informal sector.

AUTHOR CONTRIBUTIONS

Mr. Maria Vijay contributed to the introduction and analysis section of the paper. Dr. Maria Evelyn Jucunda contributed to the theory, hypothesis development, and data collection. Dr. Rekhapriyadharshini contributed to the hypothesis testing and methodology section. Dr. Sivakumar provided overall supervision of the research. Dr. Vijay Karthigeyan contributed to the final proofreading and corrections.

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CONFLICT OF INTEREST

The authors declare that there are no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy, were observed by the authors.

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ABBREVIATIONS (NOMENCLATURE)

AMOS	Analysis of Moment Structures
ASEAN	Association of South Asian Nations
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
EFA	Exploratory Factor Analysis
FA	Financial Attitude
FI	Financial Inclusion
FIN	Fintech
FK	Financial Knowledge
FL	Financial Literacy
FS	Financial Skill
GDP	Gross Domestic Product
ILO	International Labor Organization
KMO	Kaiser Mayer Olkin
MGNREG	Mahatma Gandhi National Rural Employment Guarantee
MI	Modification Indices
ML	Maximum Likelihood
ML	Maximum Likelihood
MSME	Micro, Small, and Medium Enterprises
NFI	Non-normed Fit Index
NGO	Non-Governmental Organizations
PLS	Partial Least Square
RBI	Reserve Bank of India
RBI	Reserve Bank of India
RMSEA	Root Mean Square Error of Approximation
SDG	Sustainable Development Goals
SEM	Structural Equation Model
SHG	Self-Help Group
SME	Small and Medium Enterprises
TAM	Technology Acceptance Model
TLI	Rucker-Lewis Index
US	United States
VIF	Variation Inflation Factor

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