

## Exploring the Role of Fintech Solutions on Financial Inclusion Among MSMEs in Bengaluru: The Impact of Technology Infrastructure, Regulatory Environment, and Digital Literacy

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### Abstract

The study explores the role of financial technology solutions on financial inclusion among micro, small, and medium enterprises in Bengaluru. The dimensions contributing to fintech solutions such as technology infrastructure, regulatory environment, and usage expediency are considered. The mediating effect of digital literacy of MSME owners is analyzed between fintech solutions and financial inclusion. Purposive sampling is administered to select sample of 435 MSME owners. Causal research design is adopted. Questionnaire is employed to collect data from the MSME owners. Percentage analysis, structural equation modeling, one-way ANOVA, and post-hoc tests are used to analyze data. Results showed that technology infrastructure contributes more to attain fintech solutions for MSME units. Results also confirmed that fintech solutions have the most significant influence on financial inclusion, while digital literacy does not mediate the relationship. Findings proved that age, education, annual revenue, and type of business significantly affect research variables, though gender does not. The findings provide valuable visions for enhancing financial inclusion among MSMEs and managing imminent strategies for economic growth and financial accessibility.

**Key Words:** technology infrastructure, regulatory environment, usage expediency, fintech solutions, digital literacy, financial inclusion.

### 1. Introduction and Background

Fintech solutions have played a revolutionary role in advancing financial inclusion for Micro, Small, and Medium Enterprises (MSMEs), particularly in tech-heavy locations like Bengaluru. MSMEs' capacity to obtain capital and fully engage in the economy has been greatly impacted by fintech solutions, which comprise a variety of digital financial services. The improvement of financial services accessibility is the main advantage of fintech solutions. For MSMEs, the lengthy procedures and strict standards of traditional banking systems can be prohibitive. As a result of using technology, fintech companies have created platforms that streamline these procedures, facilitating account management, transaction processing, and loan availability for small businesses. Advanced algorithms are used by digital lending platforms to evaluate creditworthiness swiftly, resulting in quicker loan approvals and payouts. For MSMEs, which frequently have liquidity issues that may impede their expansion, quick access to loans is essential (Gupta et al., 2022).

Furthermore, by cutting prices, fintech solutions have democratized access to financial services. Small businesses may find it difficult to afford the high fees and charges associated with traditional banking services. Fintech businesses are able to provide financial services at a reduced cost since they operate with fewer overhead and make use of automation. For MSMEs, conducting financial activities is more affordable because mobile banking and digital payment systems often have cheaper transaction fees than traditional banking methods. Fintech solutions offer enhanced efficiency and ease, which is a noteworthy benefit. MSMEs may handle their money and conduct financial transactions from any location at any time thanks to digital platforms. Small business owners who might not have the time or means to visit actual bank branches will especially benefit from the flexibility. Furthermore, fintech solutions frequently have

integrated tools and user-friendly interfaces that simplify financial management tasks including financial planning, invoicing, and spending tracking. This saves time and lessens administrative duties (Murinde et al., 2022).

Fintech solutions do have certain benefits, but they also have certain drawbacks when it comes to helping MSMEs achieve financial inclusion. Digital literacy is the main area of concern. Even though financial services are meant to be user-friendly, proper navigation still requires a foundational understanding of digital literacy. Small business owners, particularly in less urbanized areas, may lack the necessary skills or confidence to use these digital tools, which can limit their ability to benefit from fintech services. Data security and privacy concerns also pose significant challenges. Fintech platforms, by their nature, handle sensitive financial information. Any breaches or lapses in security can have severe consequences for MSMEs, including financial losses and damage to reputation (Yuneline, 2022). Certifying healthy cybersecurity measures is crucial to building trust among users. However, the rapid pace of technological advancement can sometimes outstrip the ability of fintech companies to keep up with emerging security threats, leaving users vulnerable.

Regulatory hurdles further complicate the operational aspects of fintech solutions. The fintech industry operates in a rapidly evolving regulatory environment. It can be difficult and expensive to comply with these rules, especially for smaller fintech businesses. Furthermore, difficulties in expanding operations and providing services to a wider clientele may arise from conflicting regulatory frameworks in various geographical areas. Navigating these regulatory complexities can be intimidating for MSMEs, which could prevent them from taking full advantage of fintech solutions. The risk of exclusion brought on by an excessive reliance on data is the primary limitation. Fintech platforms frequently employ data-driven algorithms to provide customized financial services and make loan choices. This may boost productivity, but it may also introduce biases and errors. Due to insufficient or incorrectly interpreted data, MSMEs in less formal industries or with short credit histories may unfairly suffer penalties or be denied access to financial services. Offering more easily available, reasonably priced, and effective financial services, fintech solutions have the potential to greatly improve financial inclusion for MSMEs (Nandiroh et al., 2024). Fintech may be a key player in empowering MSMEs, promoting economic growth, and developing a more equitable financial ecosystem if it can overcome these obstacles and bring benefits.

**Fintech Solutions:** Financial services for MSMEs have been transformed by fintech solutions, especially through online lending services that provide easy access to loan alternatives in a timely manner. These services, which make use of digital platforms, offer a variety of solutions that are customized to meet the various demands of small businesses, ranging from microloans to business expansion loans. The range guarantees that MSMEs will be able to locate financial products that properly match their needs. For MSMEs, the shift to simple, paperless online transactions has expedited their financial procedures. Entrepreneurs no longer need to spend time filling out paperwork and making in-person trips to financial institutions because they can now complete applications, submit documents, and receive approvals completely online. Time is saved, and essential finances are available more quickly because to the efficiency. Fintech solutions also guarantee dependable and safe service delivery. Financial transactions and data are safeguarded by strict adherence to regulations and stringent security measures. MSMEs may handle their funds securely thanks to digitalized and quick mobile banking transactions, which also increase convenience (Babajide et al., 2020). These mobile platforms enable MSMEs to focus on growth and run more efficiently by providing smooth payment options, rapid fund transfers, and real-time account monitoring. Fintech solutions provide an atmosphere that supports the growth and success of small businesses by giving MSMEs easy access to efficient, secure, and financial services.

*Technology Infrastructure:* The success of fintech solutions catering to MSMEs is contingent upon having an efficient technical infrastructure. Enormous coverage of mobile networks guarantees small enterprises access to financial services from almost anywhere, enabling mobile transactions and banking. MSMEs may now easily accept and make payments thanks to the growing availability of digital payment systems, which streamlines their financial operations and lessens their reliance on cash. Services for scalable and secure data storage are essential for safeguarding private financial data. These solutions improve the overall effectiveness of fintech platforms by supporting real-time access and processing in addition to data security (Coffie and Hongjiang, 2023). Additionally, fast data transfers and real-time user interactions are made possible by high-speed internet connectivity, which is essential for the flawless operation of financial services.

Strong mobile network coverage, easily accessible digital payment methods, safe data storage, and quick internet access all work together to provide a strong platform for fintech technologies that enable MSMEs to handle their money more skillfully and profitably.

*Regulatory Environment:* A legislative framework that is favorable to fintech solutions aimed at MSMEs is essential for their expansion. Regulations that are clear on financial technology offer a framework that promotes innovation while maintaining stability and compliance. Sensitive information is protected by laws and regulations pertaining to data privacy, which also create user confidence and prevent security breaches. Digital payments become dependable and effective for MSMEs when procedures are standardized, and security is guaranteed by guidelines for digital payment systems. Customer-friendly cybersecurity policies are crucial because they boost customer confidence in utilizing financial services while safeguarding firms from cyberattacks (Karangara, 2023). Fintech companies thrive in an environment that is well-structured and includes legislation pertaining to financial technology, effective cybersecurity standards, and laws protecting data privacy and safe digital payment procedures. In addition to encouraging innovation, the environment makes sure that fintech solutions are trustworthy, safe, and available to MSMEs, which advances financial inclusion and economic expansion.

*Usage Expediency:* For fintech solutions targeted at MSMEs to be effective, ease of use is a critical component. Transaction processing times are crucial because they improve user satisfaction and business operations when they are handled quickly and effectively. Small firms that depend on quick cash flow are especially drawn to fintech platforms that can handle transactions quickly. Customer service availability is yet another important factor. MSMEs may minimize downtime and sustain seamless operations by swiftly resolving difficulties with the help of readily available and fast support services. Business owners can manage their money outside of regular banking hours due to the flexibility offered by extended working hours for service access. Simplifying the user interface is also crucial. The user experience is improved, and the learning curve is lowered with an intuitive and simple-to-use interface. Fintech solutions may guarantee that MSMEs can fully use their services without requiring substantial technological knowledge by providing simple and user-friendly platforms, and it can increase acceptance and satisfaction (Volkodavova et al., 2019).

**Digital Literacy:** Users can access and explore a variety of online financial services by having a solid foundation in digital literacy and internet navigation skills. Strong internet navigation abilities enable MSME owners to quickly locate information, conduct transactions online, and make use of web-based financial solutions. MSMEs need to be proficient in utilizing these apps for tasks like monitoring accounts, asking for loans, and making payments. Recognizing the features and user interfaces of mobile apps can greatly improve small businesses' ability to handle their finances conveniently and efficiently. MSMEs are given the ability to make decisions about their financial access through digital financial products like investment platforms, digital wallets, and online loans (Okello et al., 2024). MSMEs need to know the best ways to protect their financial information, like creating strong passwords, spotting phishing scams, and making sure transactions are secure. Proficiency in online communication is crucial when interacting with financial providers, customer support, and other relevant parties. MSMEs can effectively resolve problems, seek help, and exchange feedback when they communicate using emails, chat rooms, and online forums. The relationship between fintech solutions and financial inclusion is mediated by digital literacy. High levels of digital literacy improve MSMEs' financial inclusion by allowing them to use different financial products, navigate fintech platforms, and secure their transactions. The potential for financial inclusion might be limited by low digital literacy, which can create obstacles to accessing and fully benefiting from fintech solutions (Mulyono, 2023).

**Financial Inclusion:** Fintech solutions' ability to financially integrate MSMEs is a game-changing force that gives them access to a vast range of financial services. Fintech platforms facilitate the acquisition of capital by MSMEs to expand their operations by improving their access to loans and other financial services. Compared to traditional banks, digital lending platforms provide speedy and frequently less biased credit choices by evaluating creditworthiness using sophisticated algorithms. Fintech technologies that make savings accounts available guarantee that MSMEs may better control their financial flows. MSMEs can easily open and manage savings accounts with digital banking platforms that offer features like automated savings, better interest rates, and seamless integration (Rahayu et al., 2023). Health, property, and liability insurance are just a few of the insurance products that fintech companies provide in a range of

customized packages for small businesses. Fintech platforms' provision of microfinance services is essential for enabling smaller MSMEs might not be eligible for conventional bank loans. The programs offer flexible-term small-scale loans to support micro-enterprises in growing and sustaining their businesses. Fintech solutions give users access to financial professionals who may give them individualized guidance as well as automated advisory services. Fintech solutions also give MSMEs access to capital and investment opportunities. Small businesses can access alternative funding sources and diversify their investments through platforms that provide peer-to-peer lending, crowdfunding, and digital investing possibilities. Fintech solutions enable MSMEs to reduce risks, take advantage of development opportunities, and manage their money more skillfully (Kofi et al., 2023).

## **2. Problem Statement**

Micro, Small and Medium Enterprises find it difficult to obtain standard financial services due to many constraints. The constraints include onerous collateral requirements, protracted approval procedures, and rigorous credit evaluations that prevent smaller enterprises from receiving funding that they require. Moreover, a sizable portion of MSMEs lack the financial literacy and digital skills necessary to make efficient use of traditional banking systems. The economic potential of the MSMEs are restricted and their progress is hindered by this financial isolation. The emergence of fintech solutions presents a positive prospect for tackling these issues; yet, its precise influence on enhancing financial inclusion for MSMEs remains inadequately studied. Realizing how fintech can close this gap is crucial to improving MSMEs' economic potential and creating a more welcoming financial climate.

## **3. Need for the Study**

Since MSMEs are essential to economic growth, it is critical to investigate how fintech solutions might help them with their financial difficulties. The various needs of these businesses are frequently not adequately met by traditional banking institutions, which results in financial exclusion. Known for its vibrant startup scene, Bengaluru is home to a sizable MSMEs that contribute significantly to the local economy. However, because it can be difficult for these businesses to obtain standard banking services, many of them suffer from financial exclusion. Given the popularity of fintech solutions, it is imperative to look into how they might improve MSMEs' access to finance in Bengaluru. The goal of the study is to determine how well fintech innovations work to give MSMEs individualized and easily accessible financial services. Examining how fintech solutions might enhance the availability of credit, savings, insurance, and financial advice services, the research will provide insightful information for financial institutions, policymakers, and fintech firms. The results will be useful in creating focused plans to improve financial inclusion, encourage MSMEs' expansion, and fortify the nation's economy as a whole.

## **4. Literature Review and Hypothesis Development**

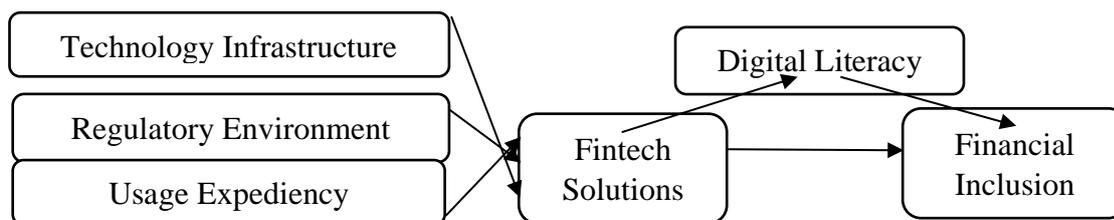
Fintech, or financial technology progress, has drastically changed the financial services industry, with a focus on MSMEs' financial inclusion. Technology infrastructure plays a fundamental part in financial solutions. Energetic technology infrastructure, comprising mobile network coverage, data storage services, and high-speed internet connectivity, is essential for the operation of fintech platforms. (Yanez-Valdes and Guerrero, 2023). Mobile networks are essential for enabling smooth transactions and interactions with fintech applications. Data storage services offer scalable and safe ways to manage enormous volumes of financial data (Gozman et al., 2018). Fast internet access is necessary for optimal user interactions with financial platforms and real-time processing. The efficacy and deployment of fintech solutions may be seriously jeopardized in the absence of these technological components (Nugraha et al., 2022). The regulatory framework that oversees fintech operations is composed of laws pertaining to financial technology, policies pertaining to data privacy, and standards for digital payments (Chemmanur et al., 2020). Rules guarantee that fintech businesses stay within the law, making innovation in a disciplined setting while defending the interests of customers. Data privacy rules safeguard private financial data, instilling confidence and motivating MSMEs to use digital financial services (Lin, 2019). Digital payment guidelines lower the risk of fraud and safeguard consumers by standardizing procedures and improving transaction dependability. Furthermore, reducing the dangers connected with online financial

transactions requires customer-friendly cybersecurity policies, which further supports the fintech industry’s widespread adoption (Ng and Kwok, 2017).

The ease with which MSMEs can engage with fintech platforms is known as usage expediency. It consists of transaction processing speeds, customer service availability, service hours, and user interface design (Lieonov et al., 2021). For MSMEs to effectively manage cash flows and react to business opportunities, transaction processing speed is essential. MSMEs can minimize operational disruptions by resolving difficulties quickly with the help of attentive customer service (Sopin, 2022). More convenience is provided to MSMEs by flexible service access hours, which enable them to interact with financial services outside of regular business hours. A user-friendly interface plays a crucial role in facilitating MSMEs’ navigation of fintech platforms, mitigating the learning curve, and improving the overall user experience. Mobile banking apps, online lending platforms, digital payment systems, and investment management tools are examples of fintech solutions (Diah and Mulia, 2023). MSMEs may easily handle payments and receipts thanks to the efficient and safe transactions made possible by digital payment systems (Purnamasari et al., 2020). Compared to traditional banks, online lending platforms provide easier access to loans, which is crucial for supplying the capital required for business expansion. Mobile banking applications provide real-time account monitoring and transaction capabilities, which improve financial management (Caisar Darma et al., 2020). Tools for investment management help MSMEs maximize their potential for growth and financial strategy. Fintech solutions’ versatility and adaptability allow them to meet the unique requirements of MSMEs, which encourages greater financial inclusion (Intan et al., 2023).

For fintech technologies to be used effectively, digital literacy is essential. It includes abilities like using mobile apps, navigating the internet, comprehending digital financial items, and becoming conscious of online security procedures (Razvan, 2021). High digital literacy MSME owners can better use fintech services to manage their credit, get loans, and make efficient use of financial tools. Knowing internet security procedures is especially crucial for preventing cyberattacks and guaranteeing secure transactions (Thomas, 2023). A higher level of digital literacy among MSME owners makes it easier for them to interact with fintech solutions and increases their capacity to profit from these advancements (Pillai et al., 2023). The capacity of MSMEs to obtain and make efficient use of financial services is known as financial inclusion. Offering substitute options for credit, savings, insurance, and money management, fintech solutions increase financial inclusion (Kandpal et al., 2023). Fintech technologies offer customized solutions and lower barriers to financial services, enabling MSMEs to overcome conventional limitations and become more actively involved in the economy (Bongomin, and Ntayi, 2020). Improved financial inclusion creates a more dynamic and inclusive financial ecosystem, which benefits not only the expansion of individual enterprises but also the overall development of the economy (Candraningrat et al., 2021). The financial inclusion of MSMEs is greatly impacted by the interplay of technology infrastructure, regulatory environment, usage expediency, fintech solutions, and digital literacy. These elements aid in identifying the benefits and difficulties of using fintech to assist MSMEs and develop a more inclusive financial viewpoint (Sari et al., 2023). The literature review supported to reach the ensuing conceptual model and hypotheses.

**Figure 1: Conceptual Framework**



*Research Hypotheses*

H<sub>1.1</sub>: Antecedents have significant impact on technology infrastructure, regulatory environment, usage expediency, fintech solutions, digital literacy, and financial inclusion.

H<sub>1,2</sub>: Technology infrastructure, regulatory environment and usage expediency have significant impact on fintech solutions.

H<sub>1,3</sub>: Fintech solutions have significant effect on financial inclusion of MSMEs.

H<sub>1,4</sub>: Digital literacy has mediating effect between fintech solutions and financial inclusion.

H<sub>1,5</sub>: Socio-economic profile of MSME owners have significant effect on research variables.

## 5. Methodology

The study utilizes appropriate methodology to examine the different parameters involved in financial inclusion of MSMEs. Purposive sampling is used to carefully select participants from a wide pool of MSME owners in Bengaluru. Based on Cochran's formula, a minimum sample size of 384 is required, but the study utilizes data of 435 MSME owners in Bengaluru. The utilization of more sample improves the reliability and validity of the findings. The study used causal research design, which is supportive to test the cause-and-effect relationship among the different variables. A structured questionnaire is used as the primary data collection tool. Socio-economic characteristics are analyzed using simple percentage analysis. Structural equation modeling evaluates the causal relationships between variables, while ANOVA and Post-Hoc tests reveal significant differences across socio-economic groups and the main research variables.

## 6. Results

### 6.1. Examination of Socio-Economic Profile

The socio-economic profile of MSME owners is analyzed in Table 1.

**Table 1: Analysis of Socio-Economic Profile**

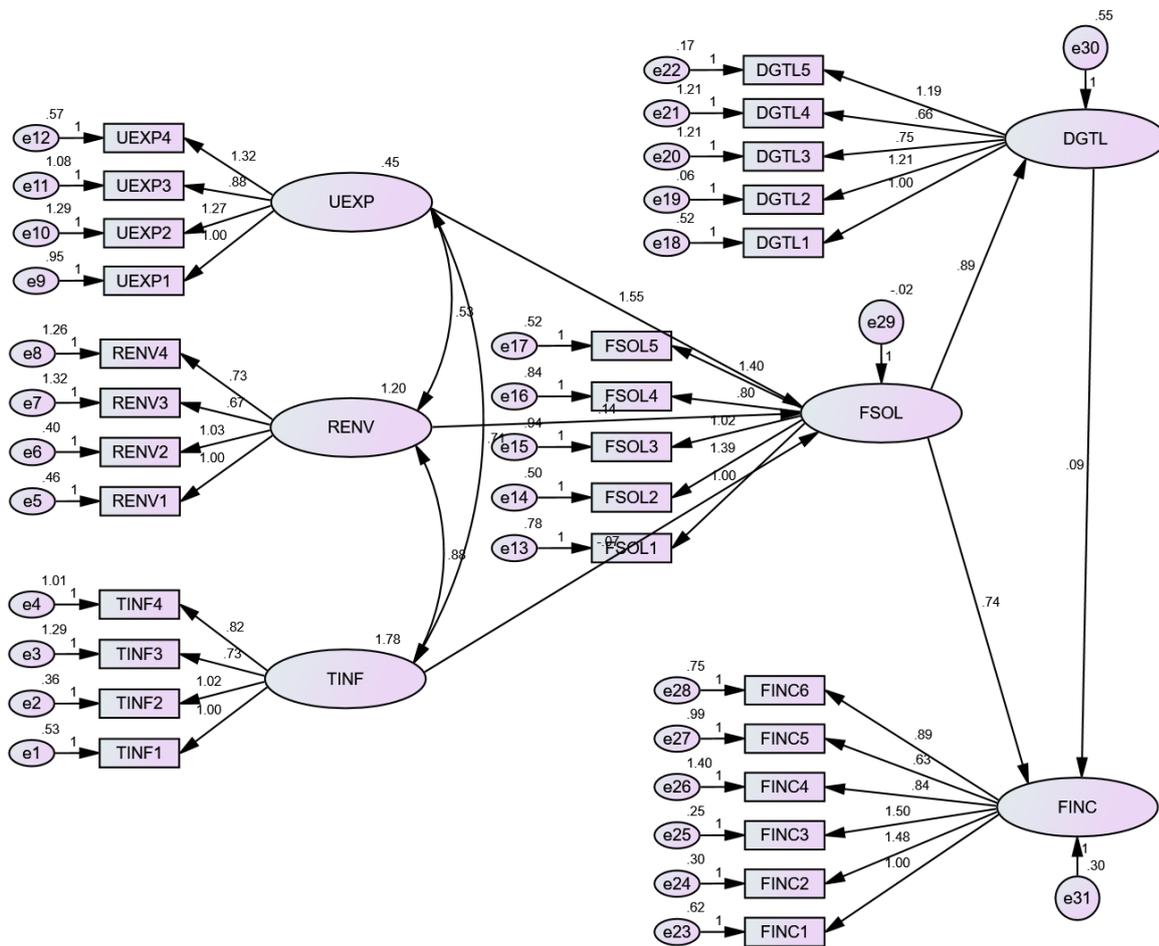
Profile	Distribution	Number	Percent
Gender	Male	327	75.2%
	Female	108	24.8%
Age	Below 30 years	97	22.3%
	30 – 45 years	199	45.7%
	Above 45 years	139	32.0%
Education	School	255	58.6%
	UG	134	30.8%
	PG	46	10.6%
Annual Revenue	Below Rs.3,00,000	159	36.6%
	Rs.3,00,000 – 5,00,000	162	37.2%
	Above Rs.5,00,000	114	26.2%
Type of Business	Service	68	15.6%
	Job-Work	148	34.0%
	Manufacturing	219	50.3%

Table 1 presents the socio-economic distribution of MSME owners based on gender, age, education, annual revenue, and business type. Among 435 MSME owners, 75.2% are male, while females account for 24.8%. In terms of age distribution, the largest group is between 30 and 45 years, representing 45.7%, followed by individuals over 45 years at 32%, and those under 30 at 22.3%. Education-wise, most participants, 58.6%, have completed schooling, 30.8% hold undergraduate degrees, and 10.6% possess postgraduate qualifications. About annual revenue, 37.2% earn between Rs.3,00,000 and Rs.5,00,000, while 36.6% earn below Rs.3,00,000, and 26.2% earn above Rs.5,00,000. Finally, 50.3% of MSMEs are involved in manufacturing, 34% in job-work, and 15.6% in services.

**6.2. Role of Fintech Solutions on Financial Inclusion of MSMEs**

The role of fintech solutions on financial inclusion of micro, small and medium enterprises are analyzed using structural equation modeling. The variables such as, Technology Infrastructure (TINF), Regulatory Environment (RENV), Usage Expediency (UEXP), Fintech Solutions (FSOL), Digital Literacy (DGTL), and Financial Inclusion (FINC). The observed, endogenous variables include TINF1 to TINF4, RENV1 to RENV4, UEXP1 to UEXP4, FSOL1 to FSOL5, DGTL1 to DGTL5, and FINC1 to FINC6. The unobserved, exogenous variables are e1 to e31, TINF, RENV, and UEXP, while FSOL, DGTL, and FINC represent the unobserved, endogenous variables. The model is composed of 65 variables in total, including 28 observed, 37 unobserved, 31 endogenous, and 34 exogenous variables. Figure 2 illustrates the structural equation model, and Table 2 presents the corresponding path analysis.

**Figure 2: Structural Equation Model**



**Table 2: Path Analysis**

Path		Unstd. Estimates	Std. Estimates	t	p	
TINF1 – Mobile network coverage	<---	1.000	.878			
TINF2 – Availability of digital payment solutions	<---	1.021	.916	26.075	***	
TINF3 – Data storage services and solutions	<---	.733	.653	15.396	***	
TINF4 – Internet connectivity and its speed	<---	.816	.735	18.311	***	
RENV1 – Financial technology regulations	<---	1.000	.849			
RENV2 – Laws and rules for data privacy	<---	1.033	.873	19.816	***	
RENV3 – Guidelines for digital payment solutions	<---	.667	.536	11.312	***	
RENV4 – Customer friendly cybersecurity policies	<---	.726	.577	12.335	***	
UEXP1 – Processing time for transaction	<---	1.000	.567			
UEXP2 – Availability of customer support	<---	1.270	.600	10.331	***	
UEXP3 – Working hours for service access	<---	.882	.494	8.925	***	
UEXP4 – User interface simplicity	<---	1.324	.761	12.086	***	
FSOL1 – Online lending services	<---	1.000	.691			
FSOL2 – Wide range of products and services	<---	1.391	.857	16.511	***	
FSOL3 – Paperless and easy online transactions	<---	1.017	.664	13.010	***	
FSOL4 – Assured and safe delivery of services	<---	.802	.593	11.691	***	
FSOL5 – Digitalized and speedy mobile banking interactions	<---	1.398	.853	16.435	***	
DGTL1 – Skills on internet navigation	<---	1.000	.826			
DGTL2 – Usage of mobile app for financial needs	<---	1.212	.982	28.418	***	
DGTL3 – Digital financial knowledge	<---	.749	.583	13.249	***	
DGTL4 – Awareness on online security for finance	<---	.660	.534	11.932	***	
DGTL5 – Online communication skills	<---	1.193	.951	27.067	***	
FINC1 – Access to credit and other financial services	<---	1.000	.747			
FINC2 – Savings account availability	<---	1.477	.923	20.315	***	
FINC3 – Insurance protection accessibility	<---	1.498	.935	20.579	***	
FINC4 – Availability of microfinance services	<---	.837	.530	11.040	***	
FINC5 – Financial advisory support and services	<---	.628	.487	10.095	***	
FINC6 – Financial and investment opportunities	<---	.889	.670	14.194	***	
FSOL	<---	UEXP	1.555	1.234	6.272	***
FSOL	<---	RENV	-.141	-.183	-2.091	.037
FSOL	<---	TINF	-.075	-.118	-2.076	.038
DGTL	<---	FSOL	.886	.711	12.499	***
FINC	<---	FSOL	.737	.704	10.041	***
FINC	<---	DGTL	.094	.112	2.168	.030

\*\*\* Significant at 1%

After implementing the structural equation model, evaluating fit indices is essential to ensure the model accurately represents the data. The results indicate a strong alignment between the model and the data. The CMIN/df value is 4.890, which falls within the acceptable range of 3 to 5, demonstrating a good fit. The RMSEA value, at 0.053, is below the maximum threshold of 0.06. Furthermore, baseline comparison indices (NFI = 0.916, RFI = 0.917, IFI = 0.918, CFI = 0.918, and TLI = 0.921) and goodness of fit indices (GFI = 0.918 and AGFI = 0.914) exceed 0.9, collectively confirming that the model fits the data well.

Table 2 reveals that the coefficient values for all paths are significant at 1% level. The p-values assure that ( $H_{1.1}$ ) antecedents have significant impact on technology infrastructure, regulatory environment, usage expediency, fintech

solutions, digital literacy, and financial inclusion. In technology infrastructure, one-unit increase in mobile network coverage, availability of digital payment solutions, data storage services, and internet connectivity will raise technology infrastructure by 1.000-unit, 1.021-unit, 0.733-unit, and 0.816-unit, respectively. Among these, the availability of digital payment solutions has the greatest impact, while data storage services have the least impact. For financial technology regulations, one-unit rise in financial technology regulations, laws and rules for data privacy, guidelines for digital payment solutions, and customer-friendly cybersecurity policies will increase the regulatory environment by 1.000-unit, 1.033-unit, 0.667-unit, and 0.726-unit, respectively. The laws and rules for data privacy exert the highest influence, whereas guidelines for digital payment solutions have the smallest effect. In the user experience domain, one-unit increase in processing time for transactions, availability of customer support, working hours for service access, and user interface simplicity will elevate user experience by 1.000-unit, 1.270-unit, 0.882-unit, and 1.324-unit, respectively. User interface simplicity has the most significant impact, with processing time for transactions having the least effect.

In relation to financial solutions, one-unit increase in online lending services, a wide range of products and services, paperless and easy online transactions, assured and safe delivery of services, and digitalized and speedy mobile banking interactions will enhance financial solutions by 1.000-unit, 1.391-unit, 1.017-unit, 0.802-unit, and 1.398-unit, respectively. Digitalized and speedy mobile banking interactions show the highest impact, while assured and safe delivery of services has the smallest impact. For digital literacy, one-unit increase in skills on internet navigation, usage of mobile apps for financial needs, digital financial knowledge, awareness of online security for finance, and online communication skills will boost digital literacy by 1.000-unit, 1.212-unit, 0.749-unit, 0.660-unit, and 1.193-unit, respectively. Usage of mobile apps for financial needs has the greatest impact, with awareness of online security for finance having the least effect. In financial inclusion, one-unit rise in access to credit and other financial services, savings account availability, insurance protection accessibility, availability of microfinance services, financial advisory support, and financial and investment opportunities will increase financial services by 1.000-unit, 1.477-unit, 1.498-unit, 0.837-unit, 0.628-unit, and -0.889 unit, respectively. Insurance protection accessibility has the highest impact, while financial advisory support shows the smallest impact.

The impact of technology infrastructure, regulatory environment and usage expediency on fintech solutions is investigated. The p-values are significant and (H<sub>1.2</sub>) is validated. Therefore, technology infrastructure, regulatory environment and usage expediency have significant impact on fintech solutions. Results proves that one-unit raise in technology infrastructure, regulatory environment and usage expediency will influence fintech solutions by 1.555-unit, -0.141-unit, and -0.075-unit respectively. Technology infrastructure contributes affirmatively but regulatory environment and usage expediency have negative effect on fintech solutions. Technology infrastructure has higher influence, and regulatory environment has lower influence on fintech solutions. The effect of fintech solutions on financial inclusion is examined, the p-value is significant. Therefore, the hypothesis (H<sub>1.3</sub>) fintech solutions has significant effect on financial inclusion of MSMEs. Results proved that technology infrastructure, regulatory environment and usage expediency effectively forms fintech solutions, eventually, fintech solutions leads to attain financial inclusion among MSMEs.

### 6.3. Mediating Effect of DGTL between FSOL and FINC

The mediation effect of digital literacy between fintech solutions and financial inclusion of MSMEs are analyzed. The hypothesis states that (H<sub>1.4</sub>) digital literacy has mediating effect between fintech solutions and financial inclusion.

**Table 3: DGTL between FSOL and FINC**

Impact	Path			Estimate	p
	DGTL	<---	FSOL		
Mediating Impact – Path A	DGTL	<---	FSOL	.886	***
Direct Impact	FINC	<---	FSOL	.737	***
Mediating Impact – Path B	FINC	<---	DGTL	.094	***

\*\*\* Significant at 1%

Table 3 highlights a significant influence of fintech solutions on financial inclusion to micro, small and medium enterprises, with a coefficient of 0.737, indicating a strong positive correlation. The mediation effect reveals that fintech solutions impact digital literacy by 0.886, while digital literacy affects financial inclusion by 0.094. The calculated mediation value is 0.083284, resulting in a total effect of 0.820284. With a variance of 0.1015, which falls below the 0.2 threshold, the absence of mediation effect is confirmed. Therefore, digital literacy does not act as a mediator between fintech solutions and financial inclusion.

#### 6.4. Effect of Socio-Economic Profile on Research Variables

The effect of socio-economic profile of MSME owners on research variables are tested with the technique of One-way ANOVA. The hypothesis proclaims that ( $H_{1.5}$ ) socio-economic profile of MSME owners have significant effect on research variables.

**Table 4: One-Way ANOVA**

Variables	Gender		Age		Education		Annual Revenue		Type of Business	
	t	Sig.	F	Sig.	F	Sig.	F	Sig.	F	Sig.
TINF	2.454	.118	29.935	.000***	18.886	.000***	18.916	.000***	20.372	.000***
RENV	1.268	.261	30.263	.000***	26.797	.000***	6.233	.000***	14.134	.000***
UEXP	.077	.781	24.575	.000***	19.563	.000***	14.662	.000***	23.547	.000***
FSOL	.009	.923	23.327	.000***	21.406	.000***	14.271	.000***	28.507	.000***
DGTL	.086	.769	29.333	.000***	19.536	.000***	19.090	.000***	24.256	.000***
FINC	3.335	.069	23.683	.000***	17.476	.000***	13.367	.000***	18.679	.000***

\*\*\* Significant at 1%

Table 4 indicates that gender does not significantly influence any of the research variables. However, age, education, annual revenue, and type of business have significant effect on variables such as technology infrastructure, regulatory environment, usage expediency, fintech solutions, digital literacy, and financial inclusion. The significant results are further tested through post-hoc tests. For age, the Tukey HSD post-hoc test identified three distinct groups; individuals under 30 years in subset *a*, those aged 30-45 years in subset *b*, and those over 45 years in subset *c* across all research variables. For education, the Scheffe post-hoc test formed two groups; MSME owners with a school-level education in subset *a*, and those with undergraduate (UG) or postgraduate (PG) qualifications in subset *b*, have impact on all variables. In terms of annual revenue, the Ryan-Einot-Gabriel-Welsch Range post-hoc test created three groups for technology infrastructure and fintech solutions; less than Rs.3,00,000 in subset *a*, Rs.3,00,000 – 5,00,000 in subset *b*, and more than Rs.5,00,000 in subset *c*. Additionally, two groups are formed for regulatory environment, usage expediency, digital literacy, and financial inclusion, with less than Rs.3,00,000 and Rs.3,00,000 – 5,00,000 in subset *a*, and more than Rs.5,00,000 in subset *b*. For the type of business, the Duncan post-hoc test created three distinct groups for technology infrastructure, regulatory environment, and financial inclusion: service businesses in subset *a*, job-work in subset *b*, and manufacturing in subset *c*. It also created two groups for usage expediency, fintech solutions, and digital literacy: service businesses in subset *a*, and job-work and manufacturing in subset *b*. It is proved that age, education, annual revenue, and type of business have significant effect on different parameters of financial inclusion of MSMEs.

## 7. Discussion and Conclusion

The study systematically investigates the role of fintech solutions in enhancing financial inclusion among micro, small, and medium enterprises. The findings emphasize that fintech solutions serve as a decisive catalyst for promoting financial inclusion, significantly influenced by technology infrastructure, regulatory frameworks, and ease of use in fintech services in MSMEs. Result demonstrates that technology infrastructure exerts the most considerable influence on fintech solutions, with elements like mobile network coverage, availability of digital payment platforms, and internet connectivity being essential. Digital payment solutions representing that a well-established technological base is vital for the growth of fintech solutions, which in turn promotes financial inclusion. The regulatory environment, while having a

smaller impact than technology infrastructure, is nonetheless important. Sound financial regulations, data privacy laws, and cybersecurity policies ensure a secure and reliable fintech ecosystem, enabling MSMEs to adopt fintech solutions more readily. Usage expediency, which involves factors like transaction processing times, customer support availability, and the simplicity of user interfaces, also significantly affects the adoption of fintech solutions. Simplicity in user interfaces representing that ease of use is an influential factor for MSMEs when adopting fintech platforms.

Result highlights that fintech solutions significantly enhance financial inclusion by improving access to credit, savings accounts, insurance protection, and other essential financial services for MSMEs. Despite the significant relationship between fintech solutions and financial inclusion, the result discloses that digital literacy does not mediate this relationship. Although fintech solutions positively impact digital literacy, the latter's influence on financial inclusion remains minimal. Therefore, digital literacy, while valuable, does not significantly alter the relationship between fintech adoption and the extent of financial inclusion achieved by MSMEs. Furthermore, the effect of the socio-economic profiles of MSME owners confirms that gender does not have a significant influence. However, age, education, annual revenue, and type of business have a notable impact on technology infrastructure, regulatory environment, usage expediency, fintech solutions, digital literacy, and financial inclusion. Post-hoc tests provide further clarity, highlighting distinct differences based on these socio-economic factors. In conclusion, technology infrastructure and fintech solutions are paramount, while digital literacy's role as a mediator is limited towards financial inclusion among MSMEs. Findings guide policymakers and businesses in creating strategies to improve financial accessibility and economic development for MSMEs.

## 8. Research Implications

The study on the role of fintech solutions in financial inclusion of MSMEs in Bengaluru offers serious instincts for policymakers, financial institutions, and fintech companies. Findings emphasize the need to improve technology infrastructure, simplify regulatory frameworks, and enhance user-friendly fintech platforms to boost financial inclusion. Policymakers should prioritize digital payment solutions and mobile network expansion, while ensuring a secure regulatory environment that develops MSME participation. Fintech firms should focus on user interface simplicity to improve adoption rates among MSMEs. Additionally, digital literacy initiatives can complement fintech adoption, though it does not directly mediate financial inclusion. To sum up, the study ensures a roadmap for promoting sustainable growth and financial accessibility for MSMEs in Bengaluru.

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